Vorlesung Klappenerkrankungen

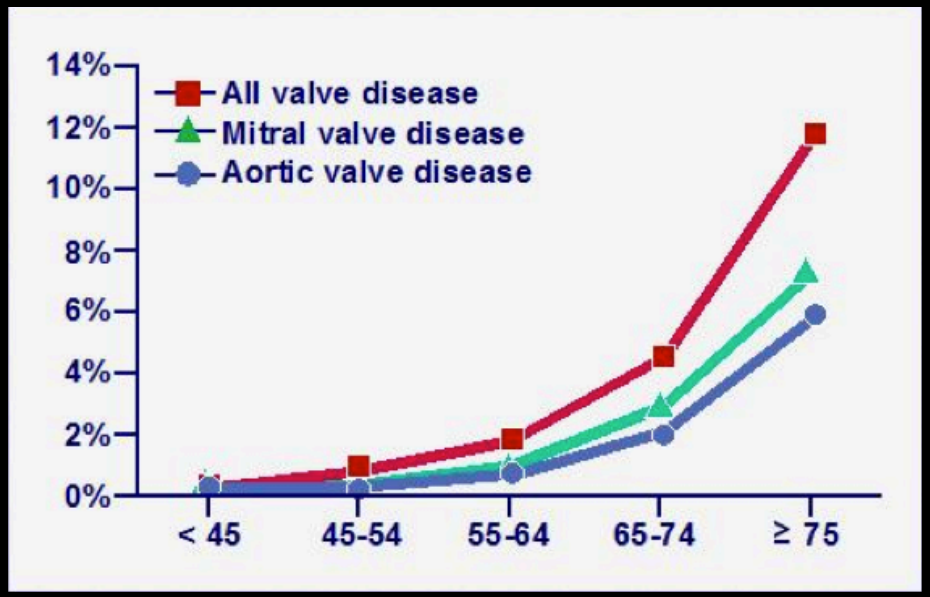
Mitralklappe
Tricuspidalklappe

UniversitätsSpital Zürich

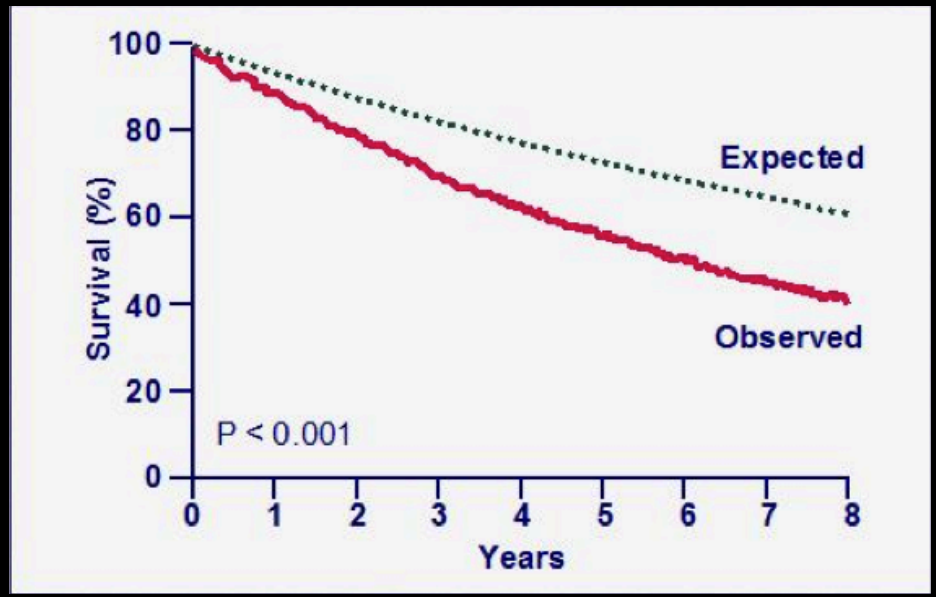
UNIVERSITAS TURICENSIS MDCCC XXXIII

Klappenerkrankungen

Prävalenz



Prognose

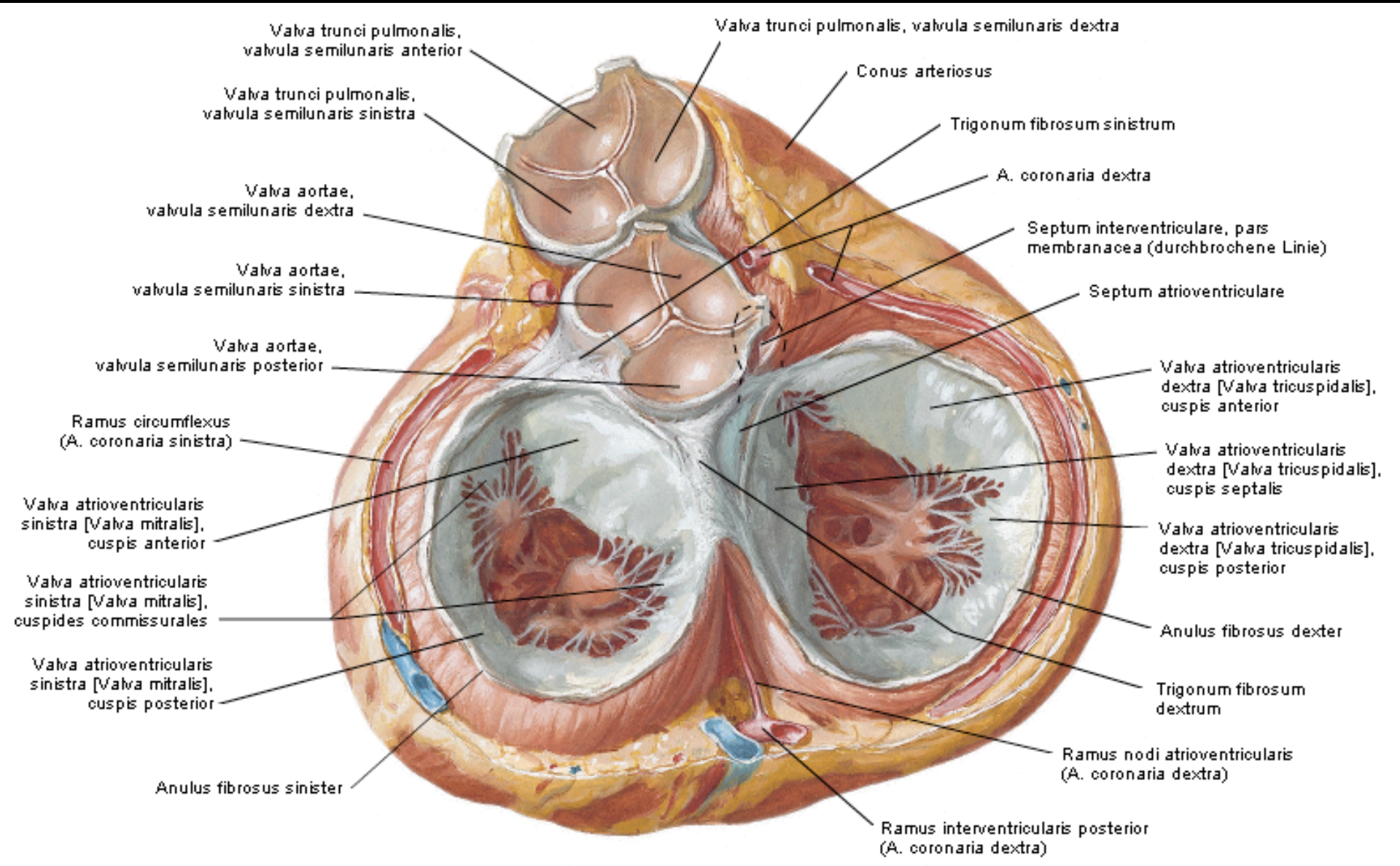


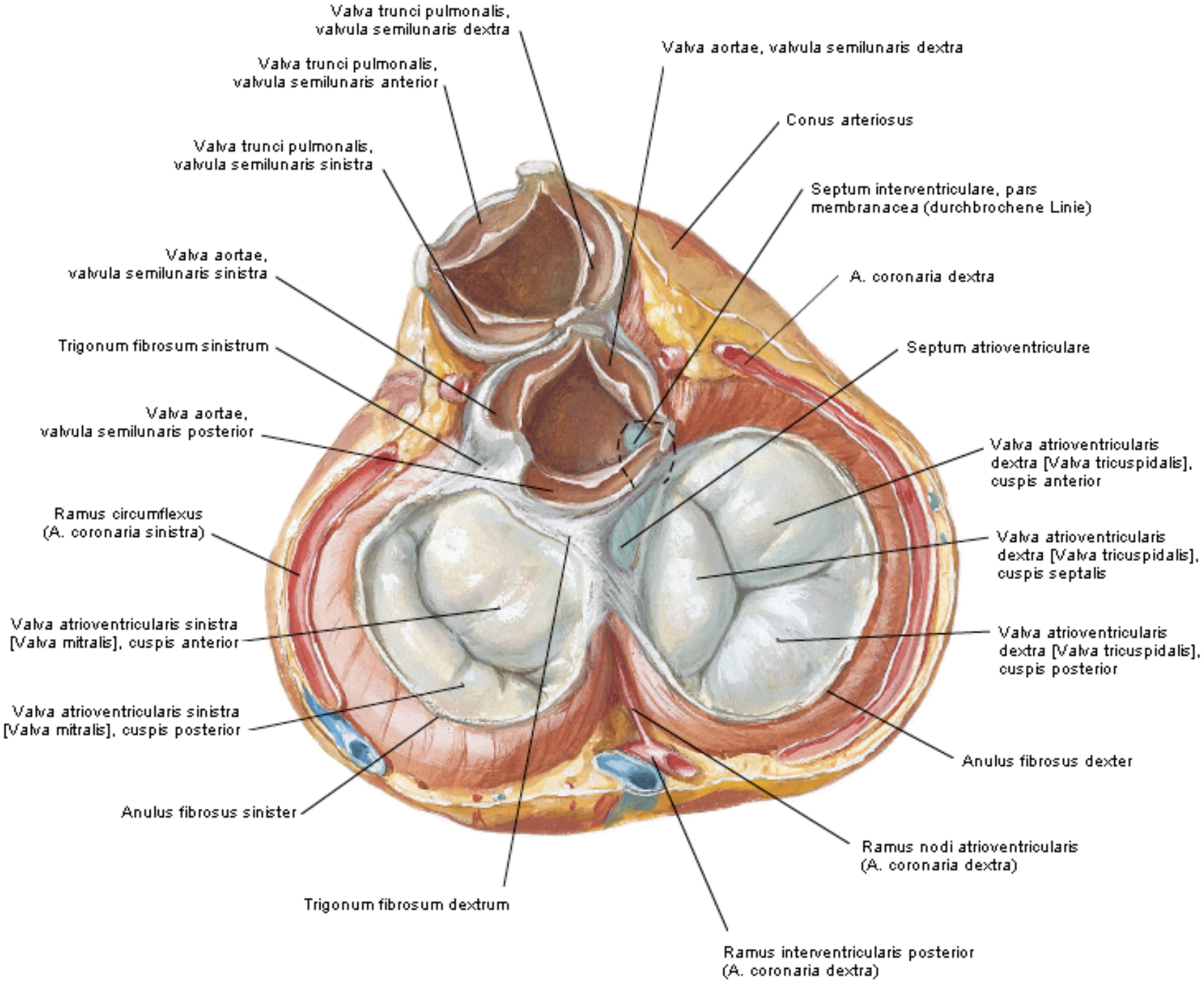
Nkomo et al. Lancet 2006;368:1005-1011

Mitralklappenerkrankungen

Mitralinsuffizienz

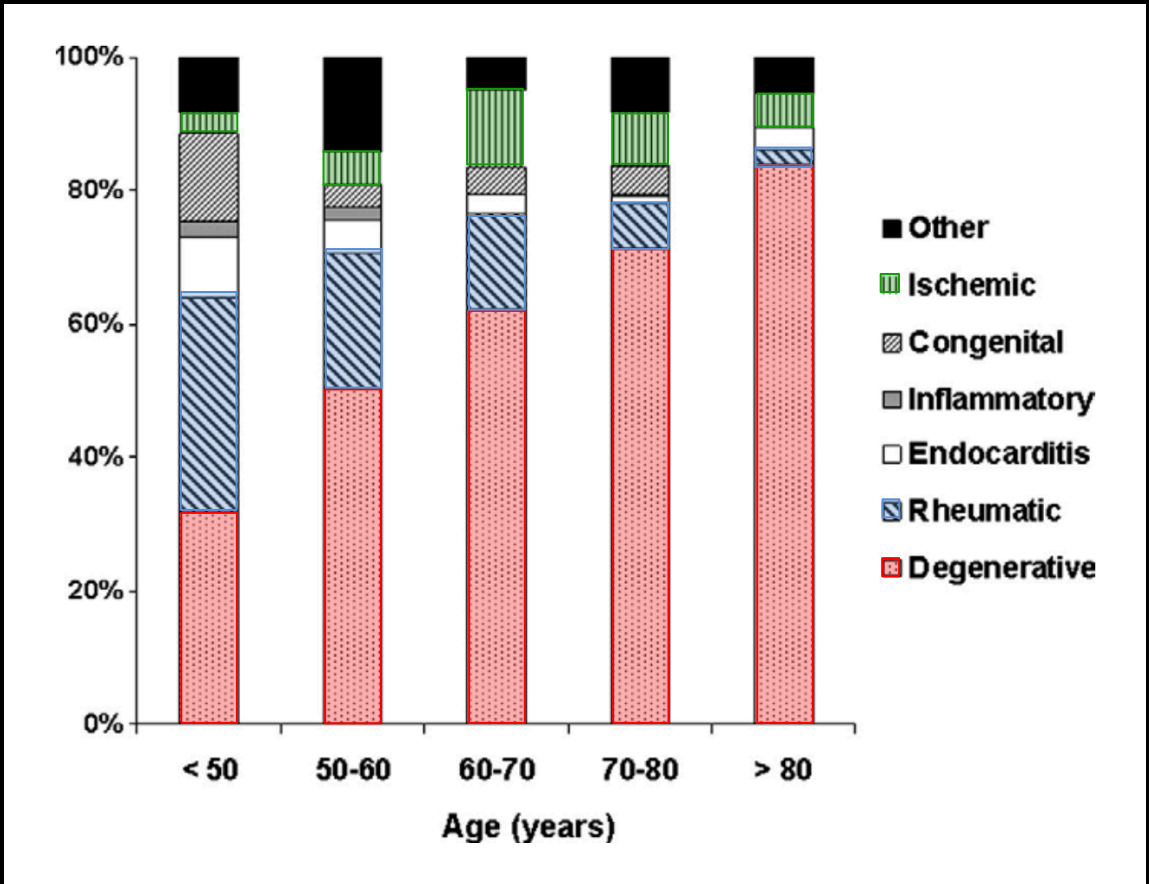
Mitralstenose


Valva trunci pulmonalis, valvula semilunaris anterior
Valva trunci pulmonalis, valvula semilunaris dextra
Conus arteriosus
Valva trunci pulmonalis, valvula semilunaris sinistra
Trigonum fibrosum sinistrum
A. coronaria dextra
Valva aortae, valvula semilunaris dextra
Septum interventriculare, pars membranacea (durchbrochene Linie)
Valva aortae, valvula semilunaris sinistra
Septum atrioventriculare
Valva aortae, valvula semilunaris posterior
Valva atrioventricularis dextra [Valva tricuspidalis], cuspis anterior
Ramus circumflexus (A. coronaria sinistra)
Valva atrioventricularis dextra [Valva tricuspidalis], cuspis septalis
Valva atrioventricularis sinistra [Valva mitralis], cuspis anterior
Valva atrioventricularis dextra [Valva tricuspidalis], cuspis posterior
Valva atrioventricularis sinistra [Valva mitralis], cuspides commissurales
Anulus fibrosus dexter
Valva atrioventricularis sinistra [Valva mitralis], cuspis posterior
Trigonum fibrosum dextrum
Ramus nodi atrioventricularis (A. coronaria dextra)
Anulus fibrosus sinister
Ramus interventricularis posterior (A. coronaria dextra)


Valva trunci pulmonalis, valvula semilunaris dextra
Valva aortae, valvula semilunaris dextra
Valva trunci pulmonalis, valvula semilunaris anterior
Conus arteriosus
Valva trunci pulmonalis, valvula semilunaris sinistra
Septum interventriculare, pars membranacea (durchbrochene Linie)
Valva aortae, valvula semilunaris sinistra
A. coronaria dextra
Trigonum fibrosum sinistrum
Septum atrioventriculare
Valva aortae, valvula semilunaris posterior
Valva atrioventricularis dextra [Valva tricuspidalis], cuspis anterior
Ramus circumflexus (A. coronaria sinistra)
Valva atrioventricularis dextra [Valva tricuspidalis], cuspis septalis
Valva atrioventricularis sinistra [Valva mitralis], cuspis anterior
Valva atrioventricularis dextra [Valva tricuspidalis], cuspis posterior
Valva atrioventricularis sinistra [Valva mitralis], cuspis posterior
Anulus fibrosus dexter
Anulus fibrosus sinister
Ramus nodi atrioventricularis (A. coronaria dextra)
Trigonum fibrosum dextrum
Ramus interventricularis posterior (A. coronaria dextra)

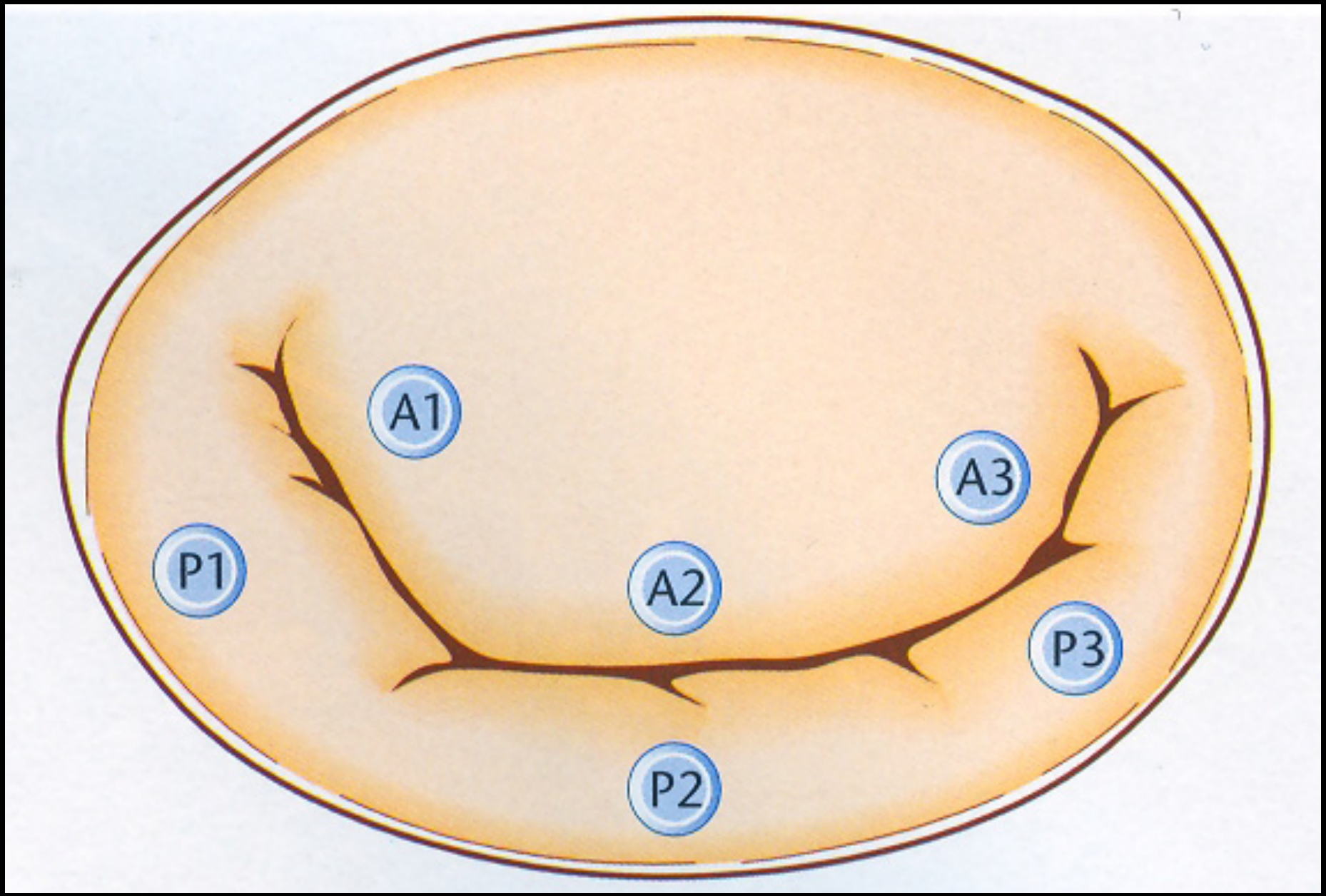
Ursachen der Mitralinsuffizienz

Verteilung der Ursachen nach Alter

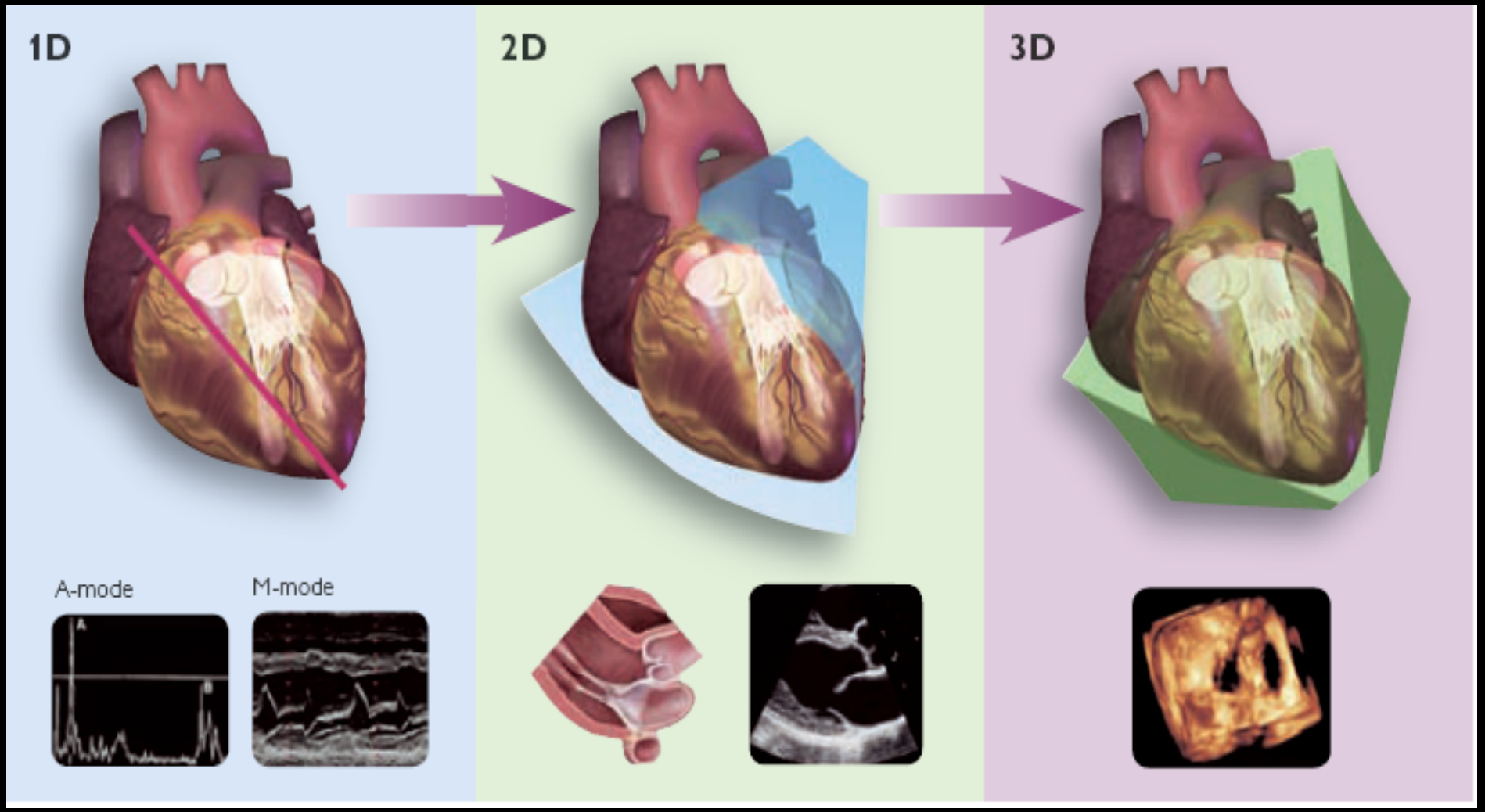


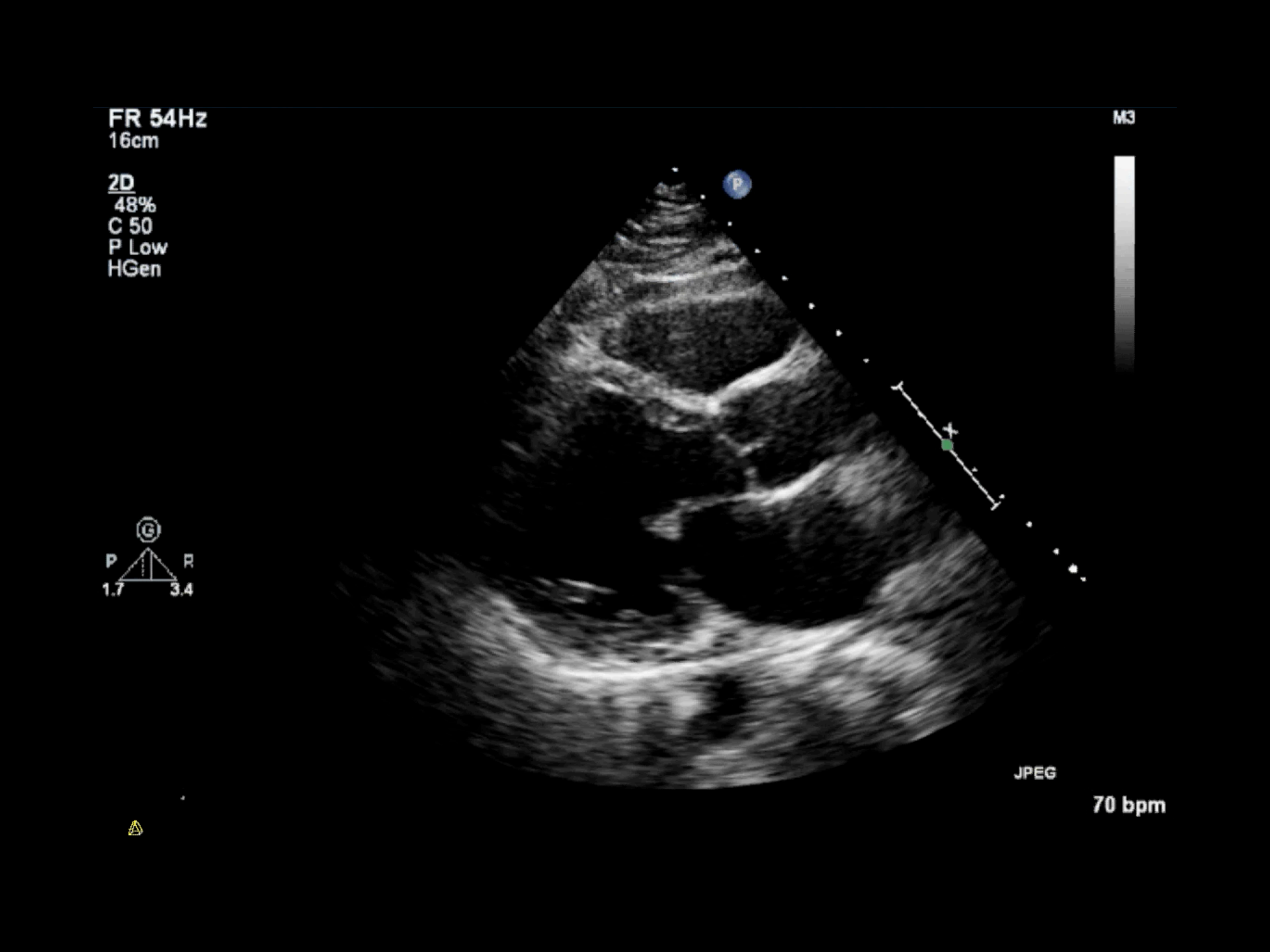
Iung et al. Curr Probl Cardiol 2007;32:609-661

Mitralklappe: Anatomie



Echokardiographie bei Mitralklappenerkrankungen

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C 50
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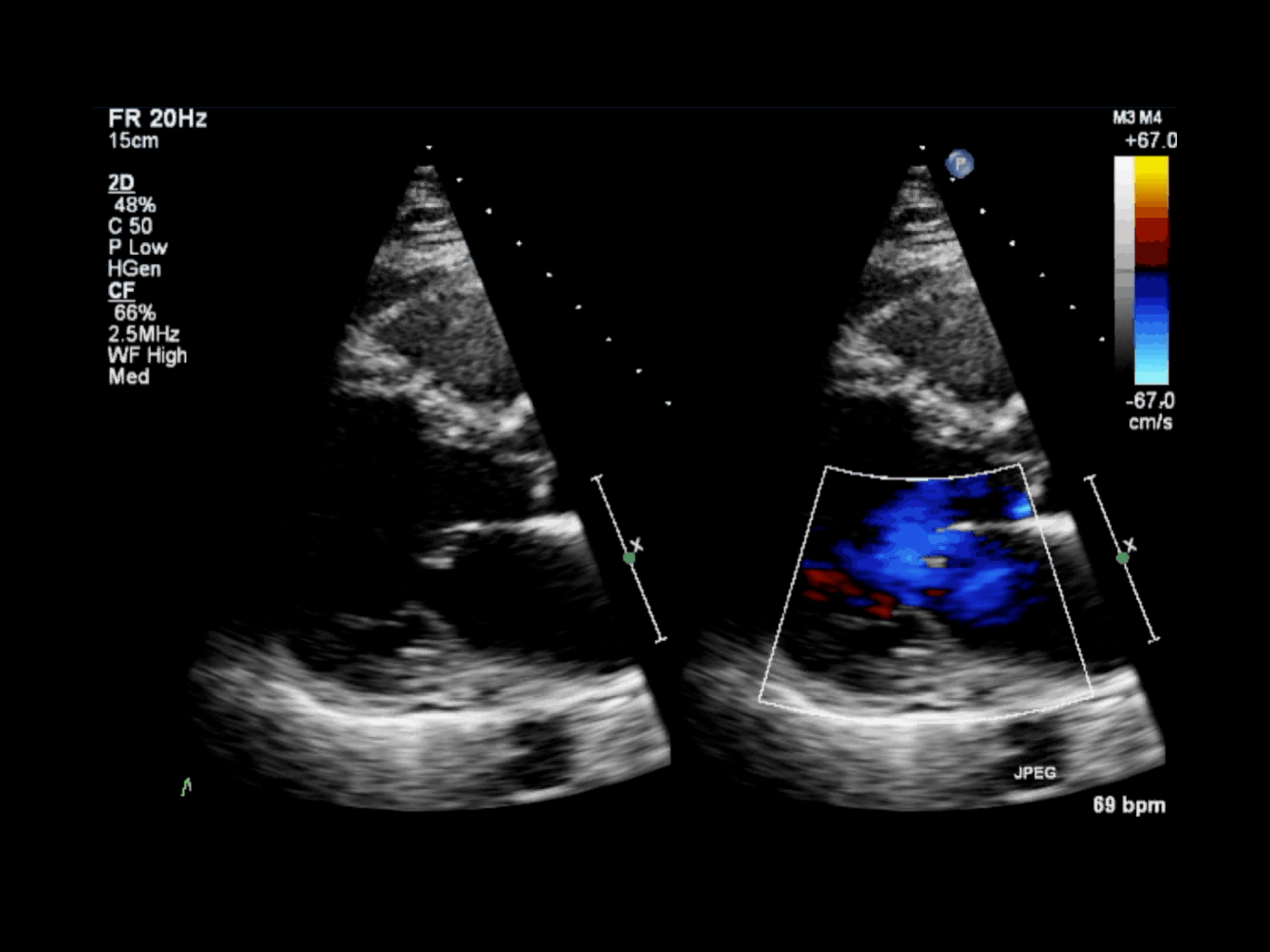
HGen
M3
P
G
P
R
1.7
3.4
JPEG
70 bpm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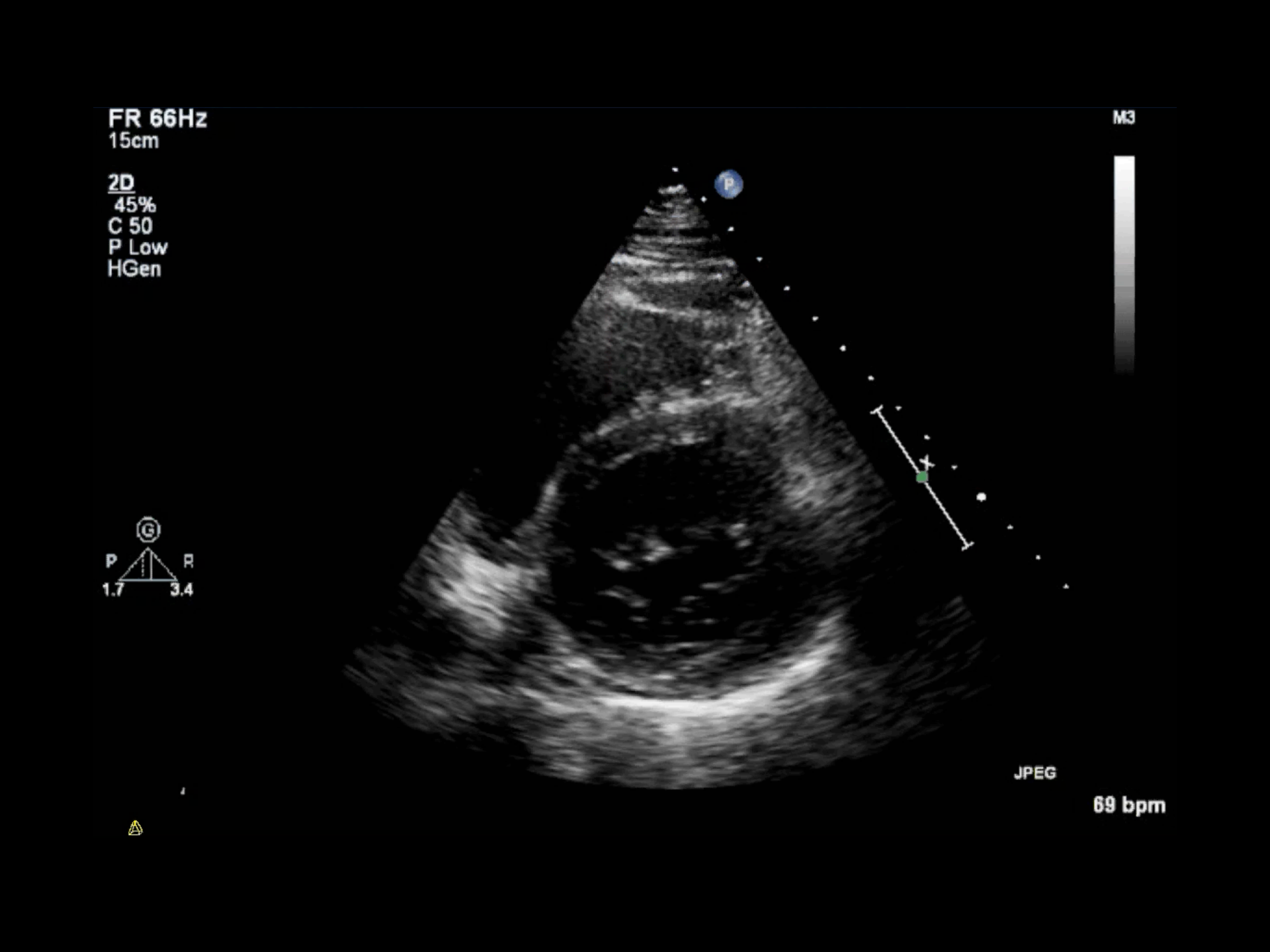
15cm
2D
48%
C 50
P Low
HGen
CF
66%
2.5MHz
WF High
Med
M3 M4
+67.0
-67.0
cm/s
JPEG
69 bpm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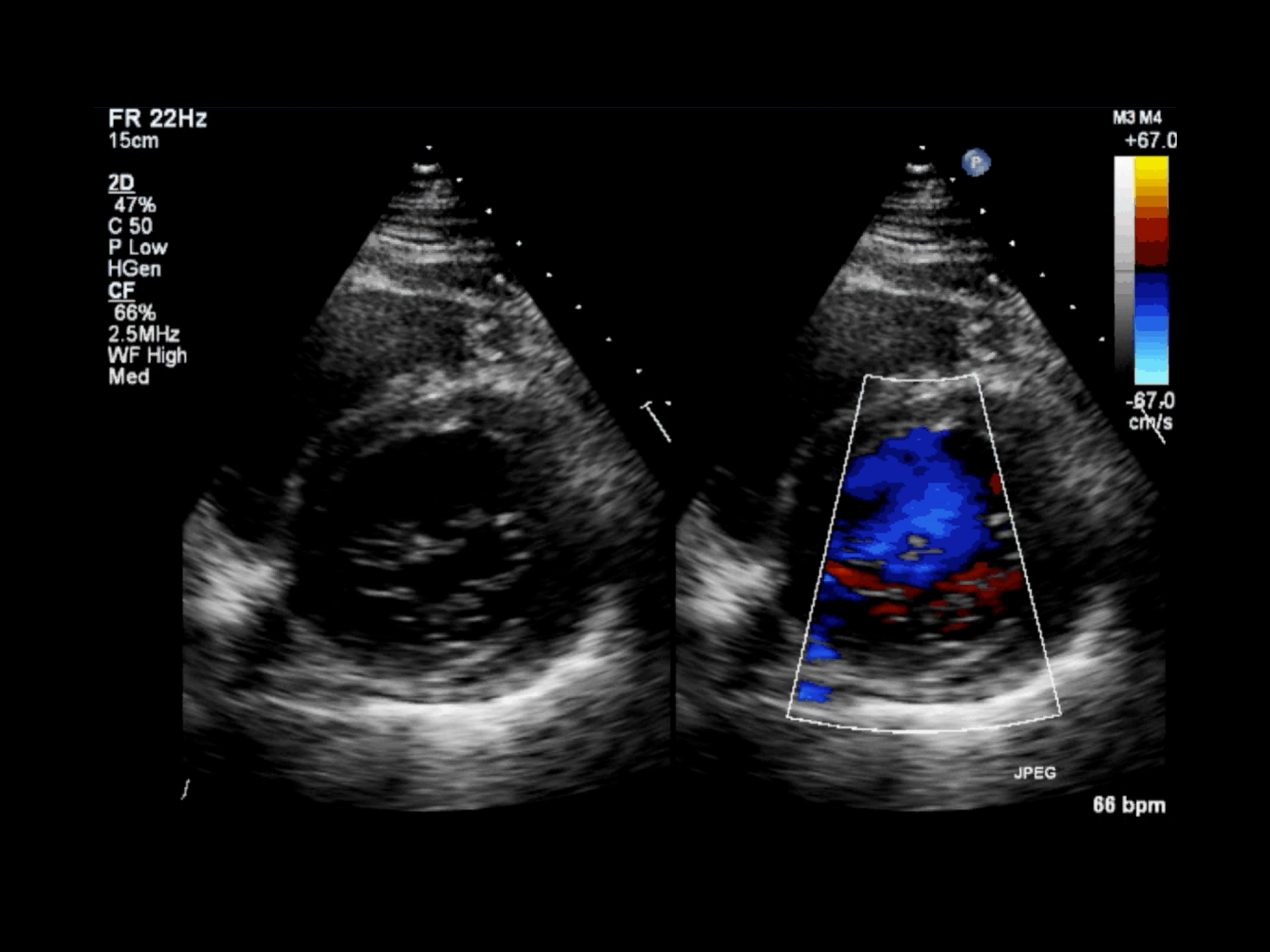
45%
C 50
P Low
HGen
M3
P
G
P
R
1.7
3.4
JPEG
69 bpm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15cm
2D
47%
C 50
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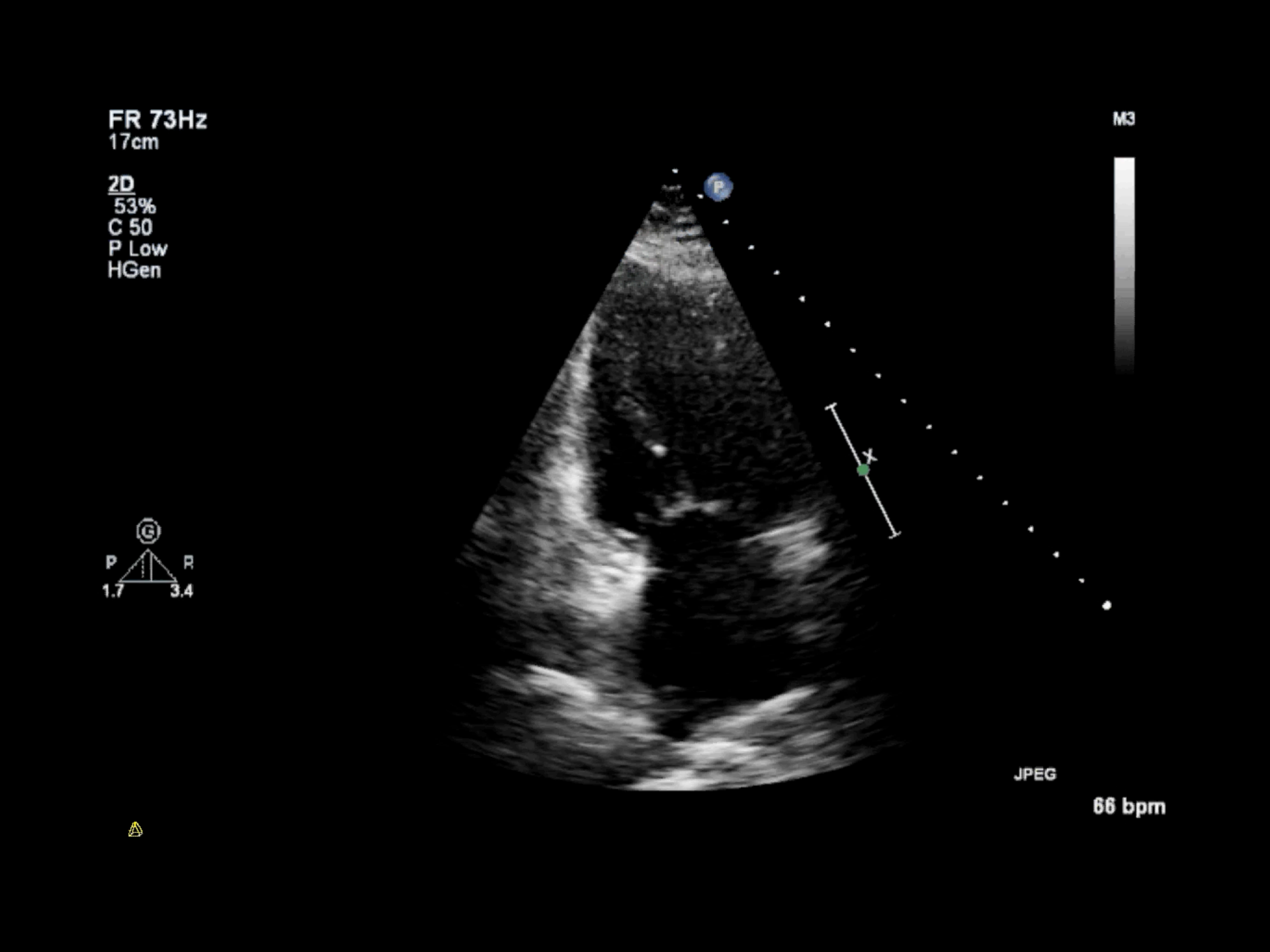
HGen
CF
66%
2.5MHz
WF High
Med
M3 M4
+67.0
-67.0
cm/s
JPEG
66 bpm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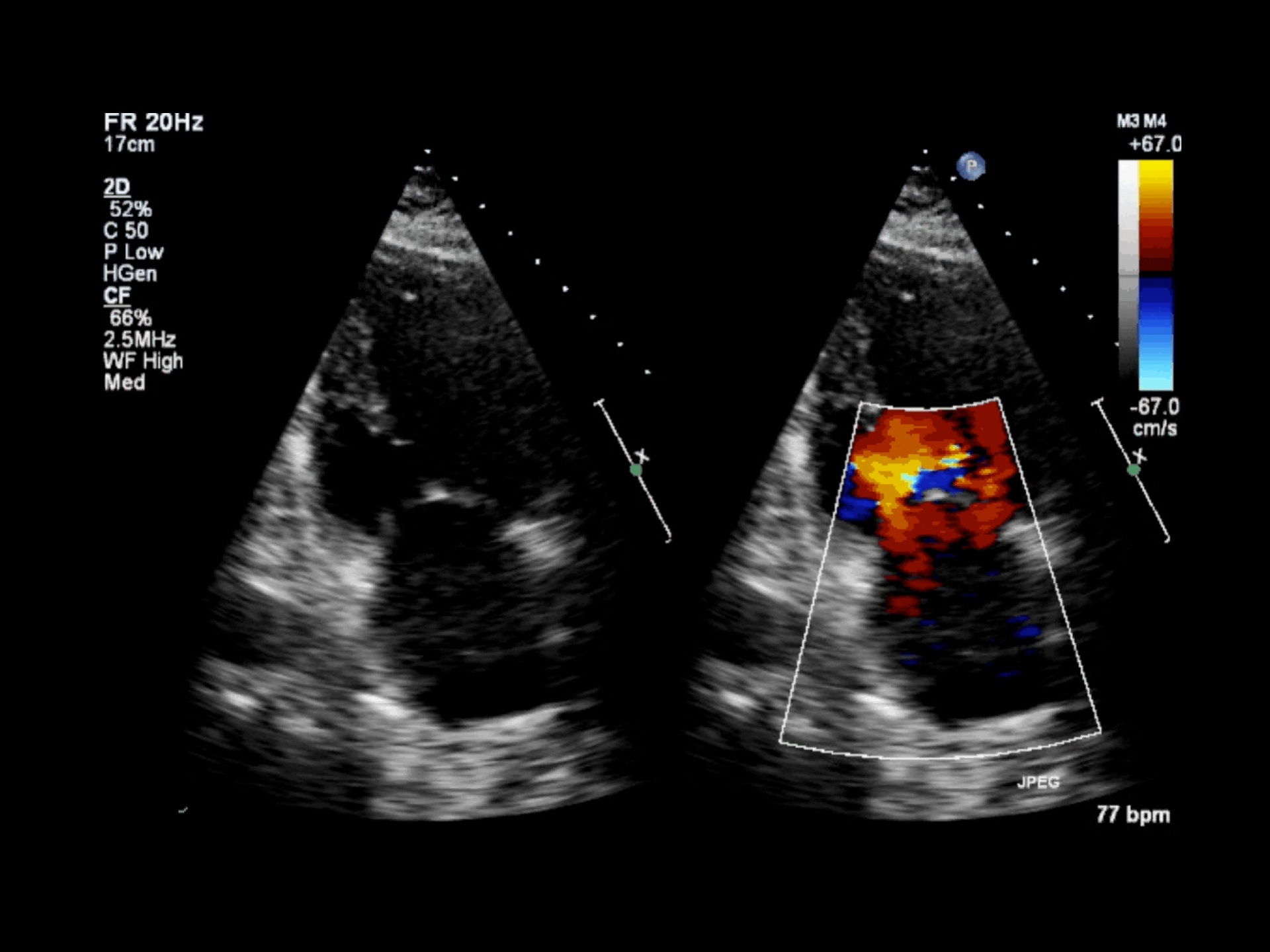
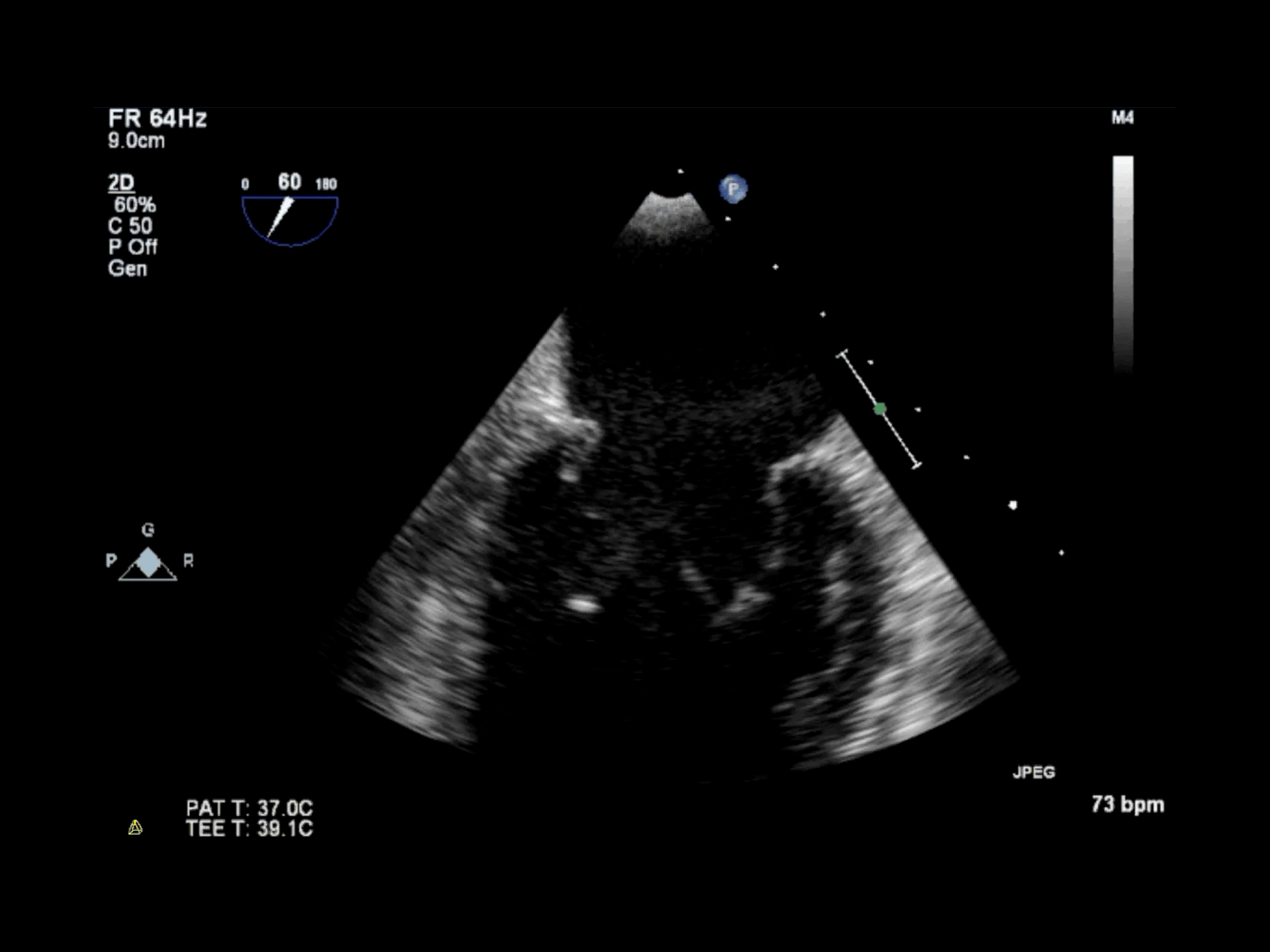
17cm
2D
53%
C 50
P Low
HGen
M3
P
G
P
R
1.7
3.4
JPEG
66 bpm


FR 20Hz
17cm
2D
52%
C 50
P Low
HGen
CF
66%
2.5MHz
WF High
Med
M3 M4
+67.0
-67.0
cm/s
JPEG
77 bpm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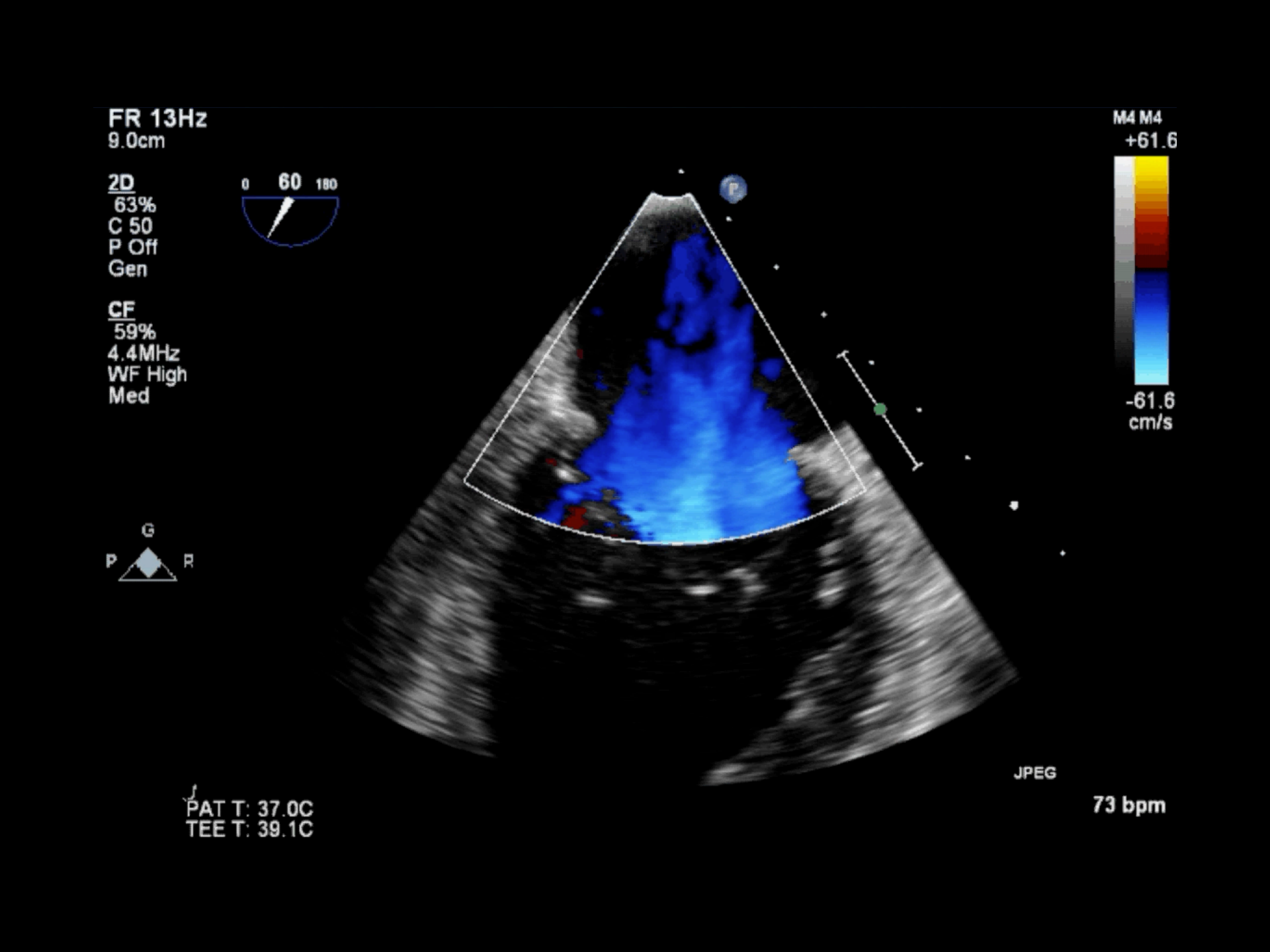
9.0cm
2D
60%
C 50
P Off
Gen
0
60
180
M4
G
P
R
JPEG
PAT T: 37.0C
TEE T: 39.1C
73 bpm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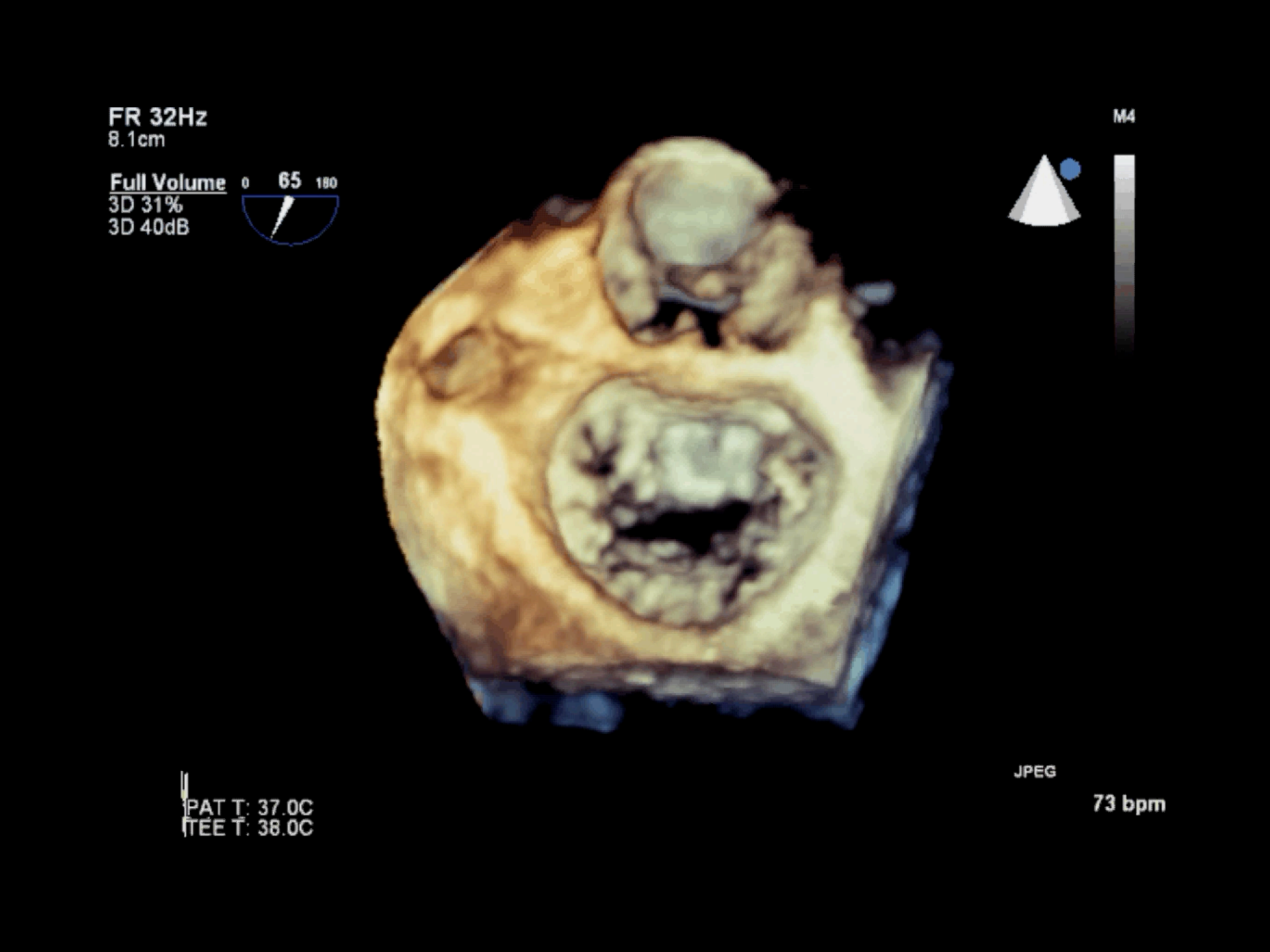
P Off
Gen
CF
59%
4.4MHz
WF High
Med
0
60
180
G
P
R
M4 M4
+61.6
-61.6
cm/s
JPEG
PAT T: 37.0C
TEE T: 39.1C
73 bpm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8.1cm
Full Volume
3D 31%
3D 40dB
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65
180
M4
JPEG
73 bpm
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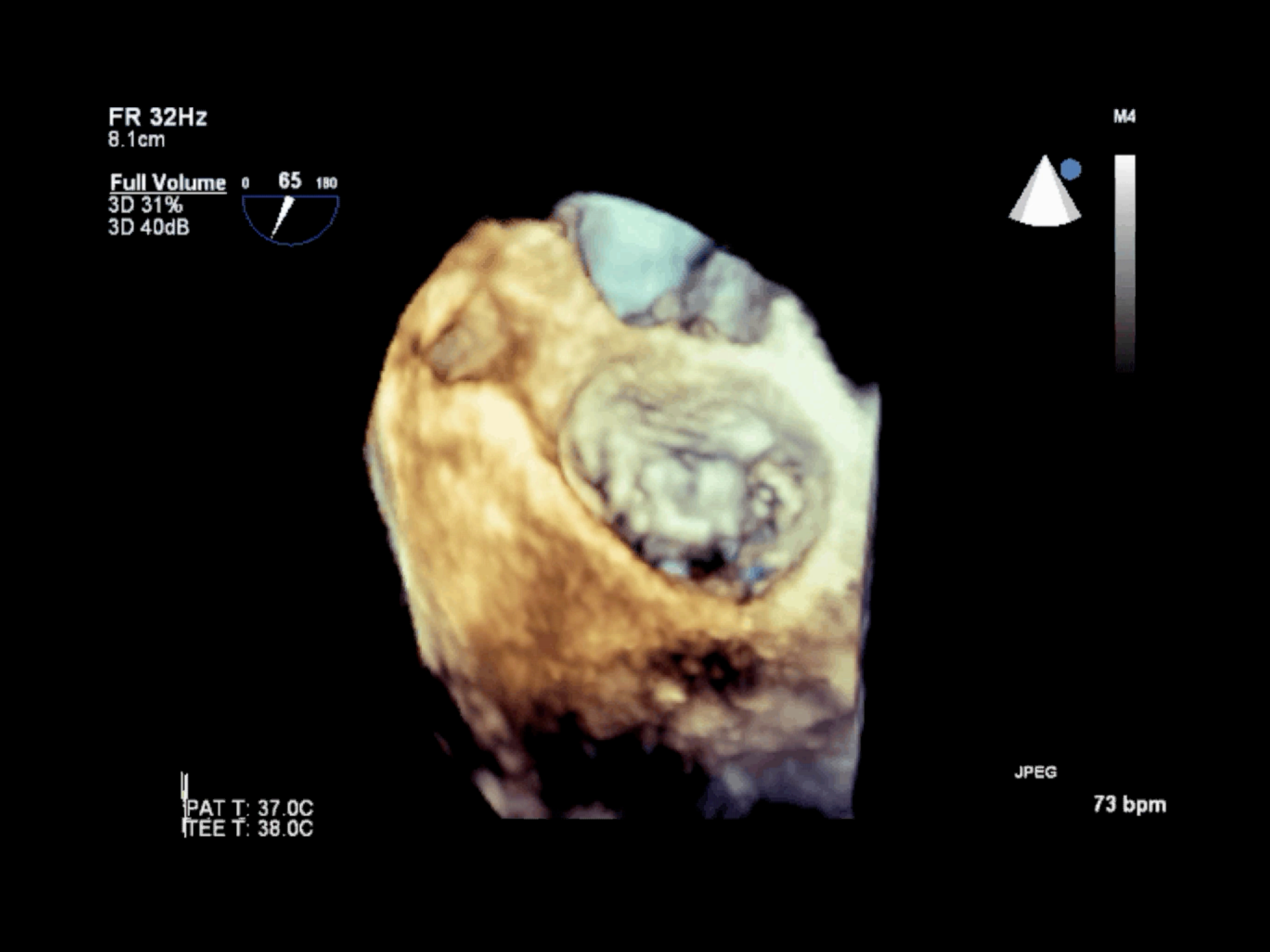
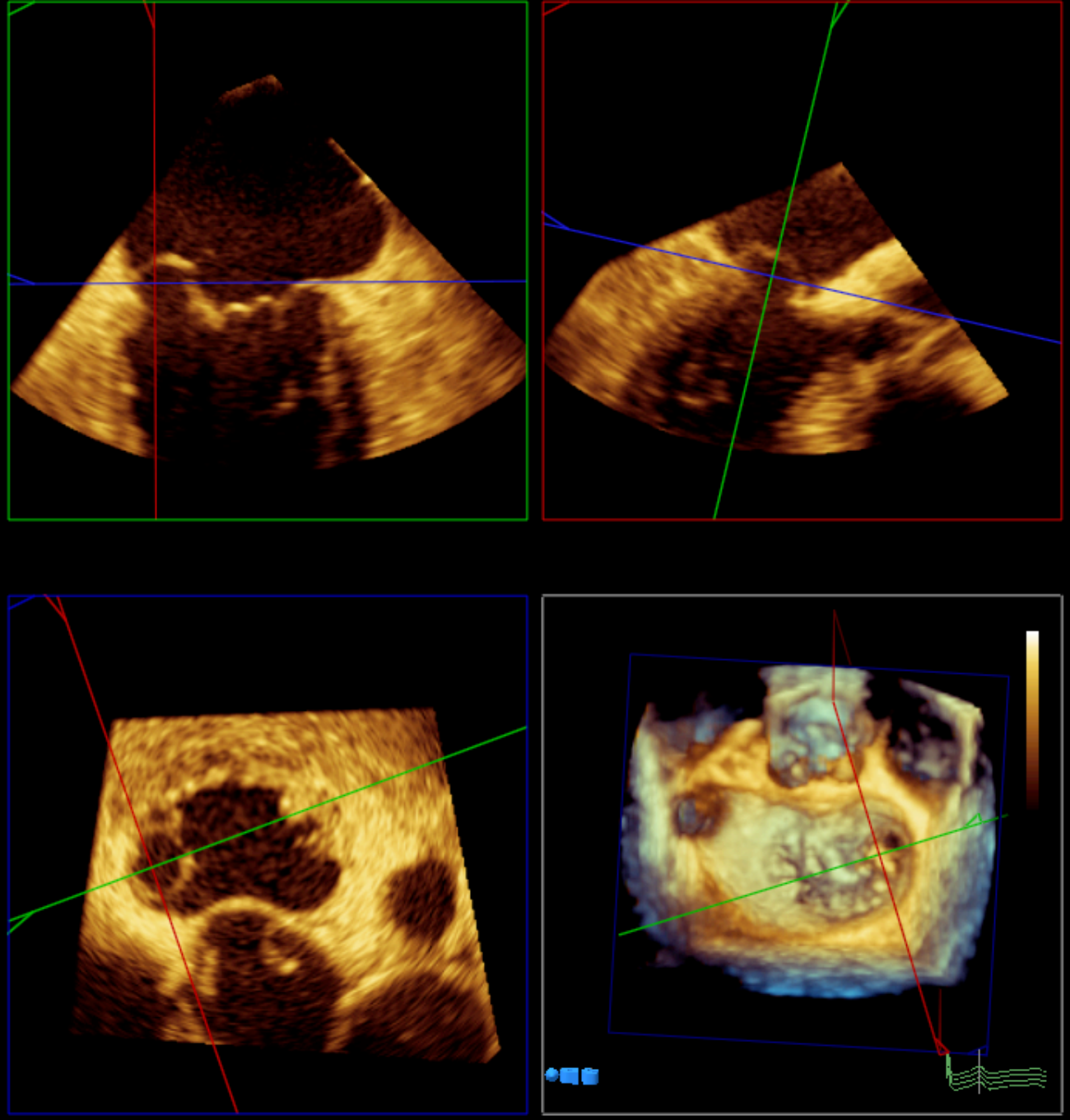
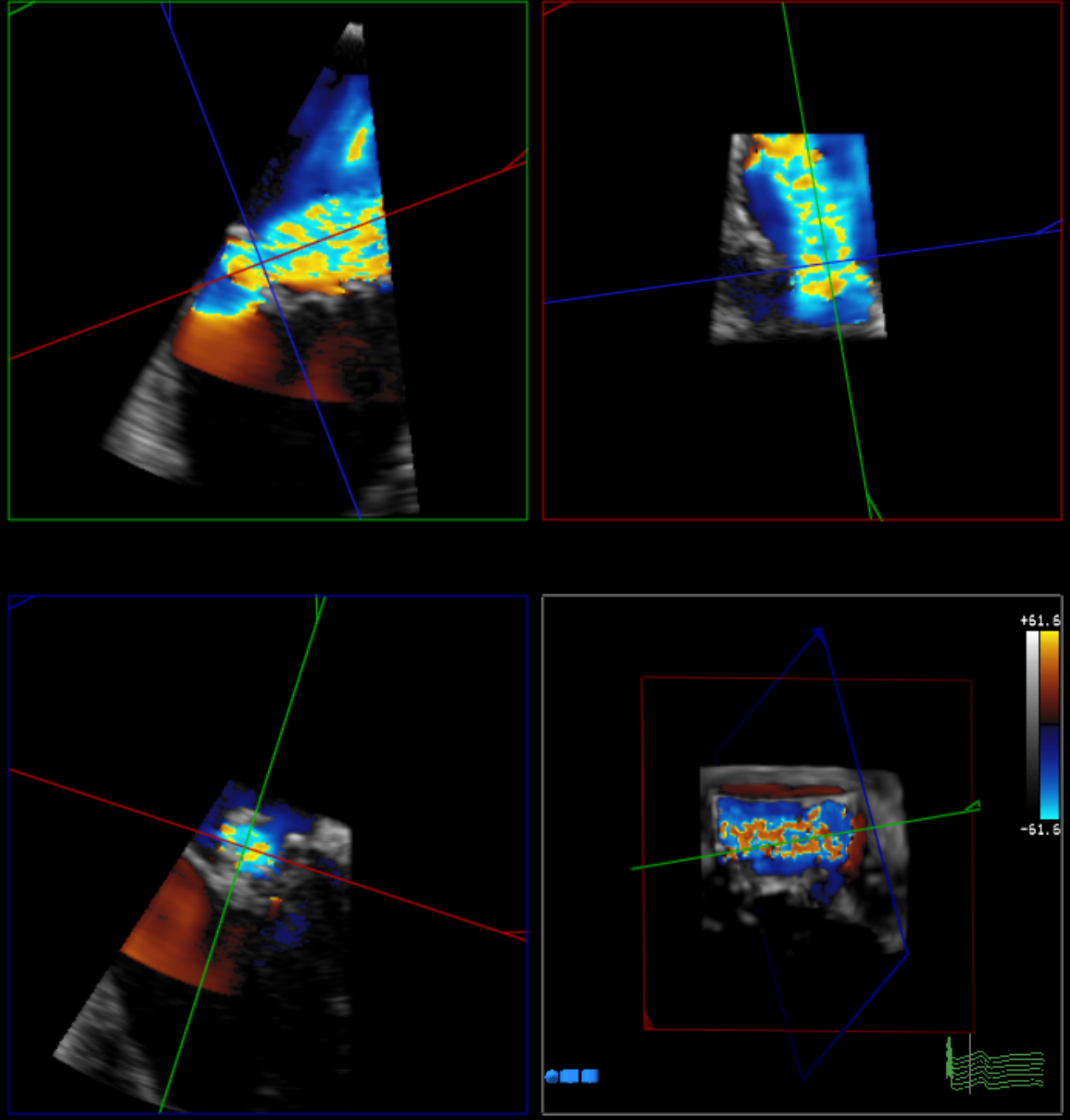
TEE T: 38.0C

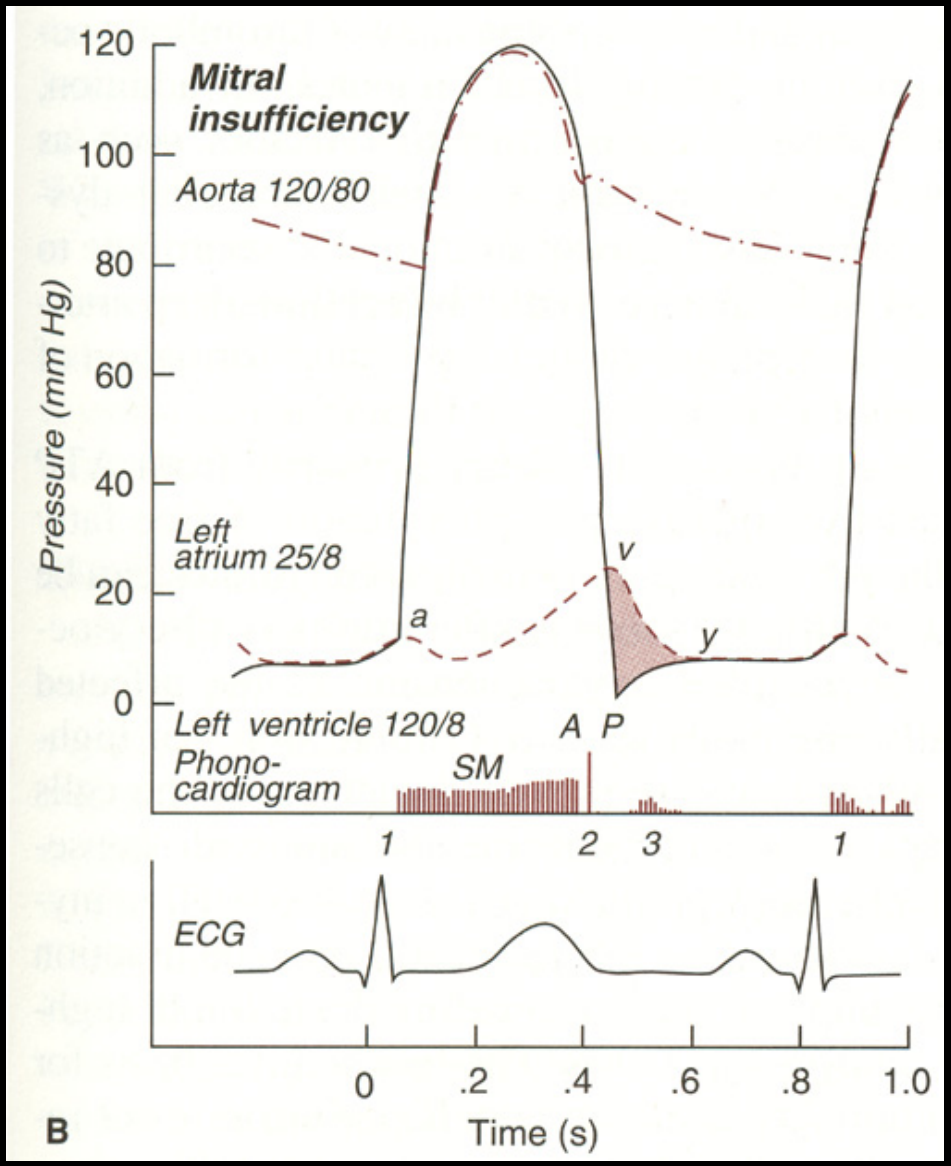

FR 32Hz
8.1cm
Full Volume
3D 31%
3D 40dB
0
65
180
M4
PAT T: 37.0C
TEE T: 38.0C
JPEG
73 bpm

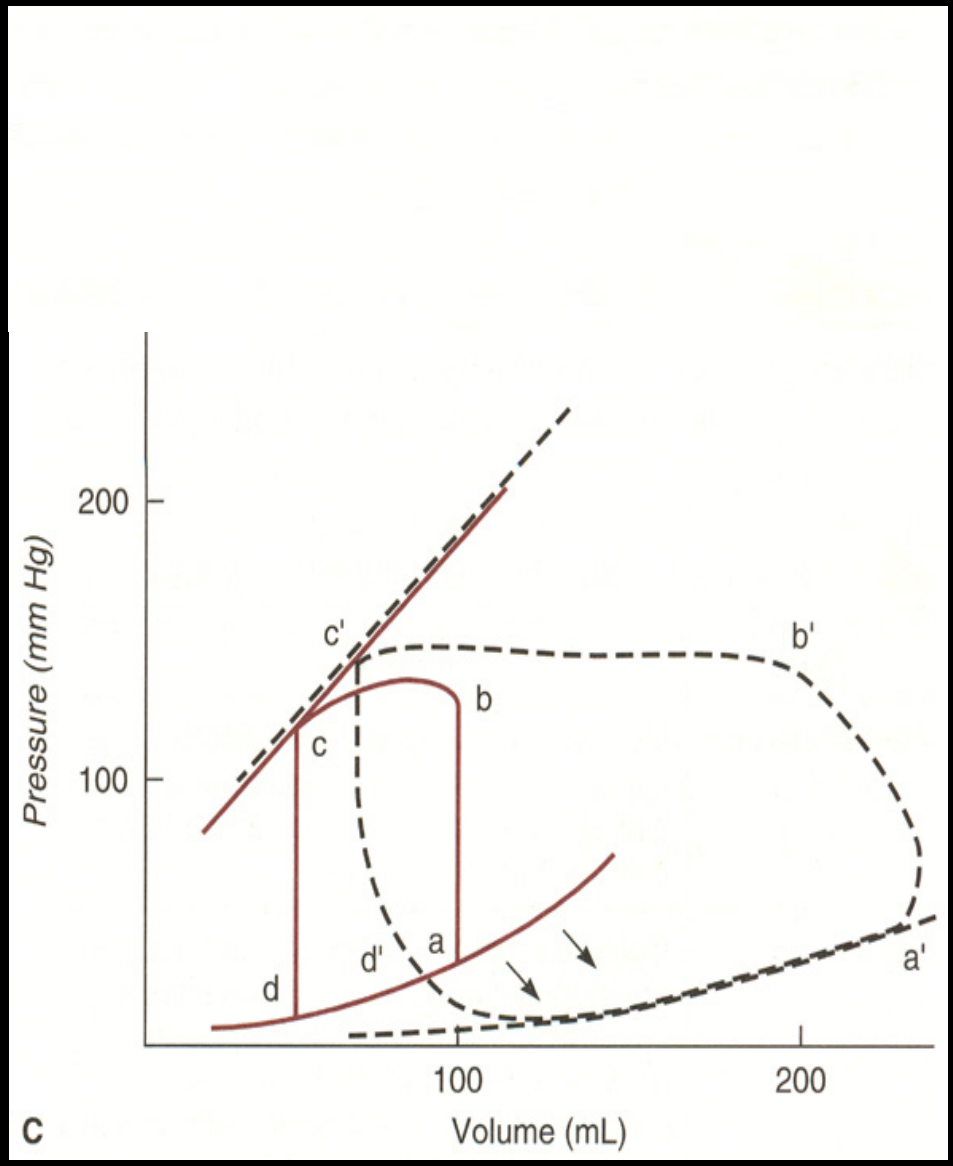

PHILIPS



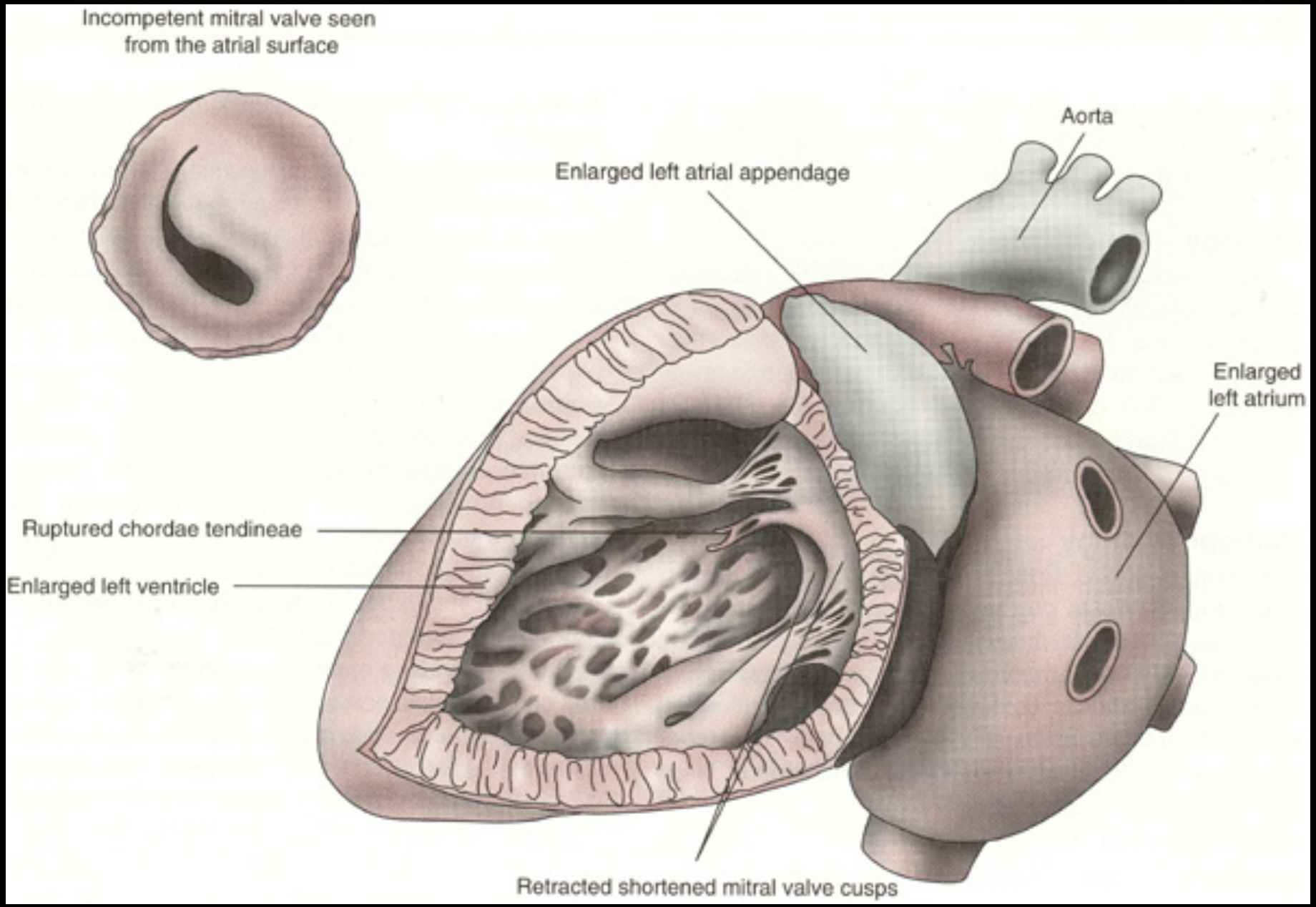
PHILIPS

Hämodynamik der Mitralinsuffizienz





Folgen der Mitralinsuffizienz



Mitralinsuffizienz und kardiale Funktion

Linker Ventrikel:

Volumenüberlastung
Progressive Dilatation
Myokardiale Hypertrophie
Systolische Dysfunction
Ventrikuläre Arrhythmien

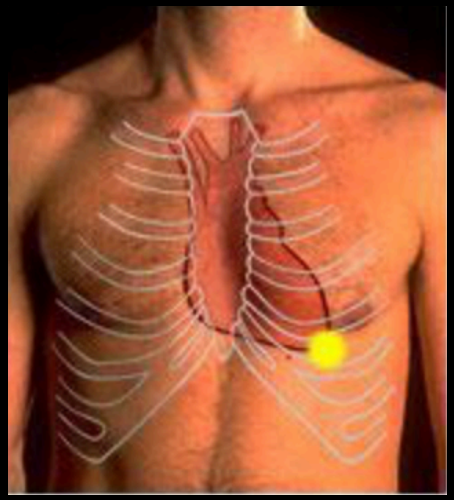
Linker Vorhof:

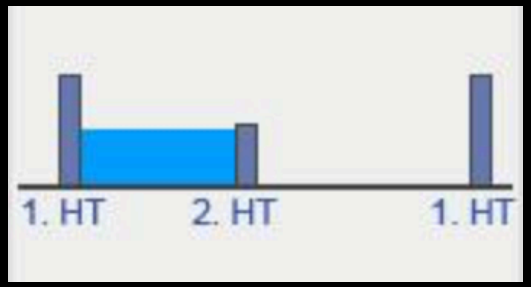
Progressive Dilatation
Atriale Arrhythmien
Atriale Thromben

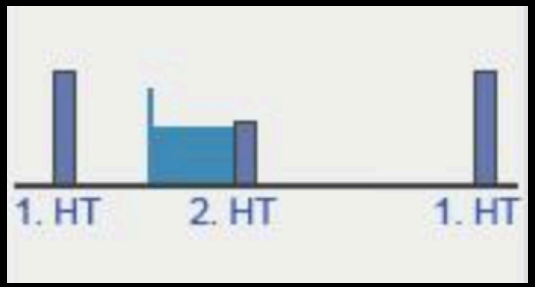
Sekundäre pulmonale Hypertonie

Mitralinsuffizienz

Untersuchung von Patienten mit MI







1: normal
2: normal
Holosystolisches Geräusch, bandförmig, fauchend
Ausstrahlung in Axilla, v. a. in Linksseitenlage
3: häufig vorhanden
MKP: systolischer Click und daran anschliessend MI

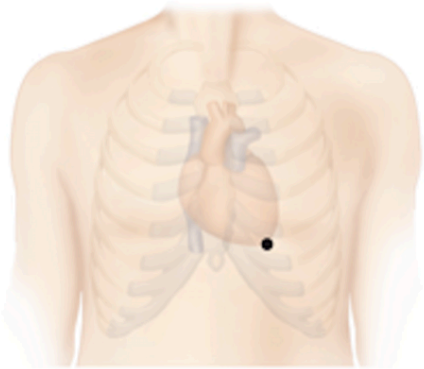
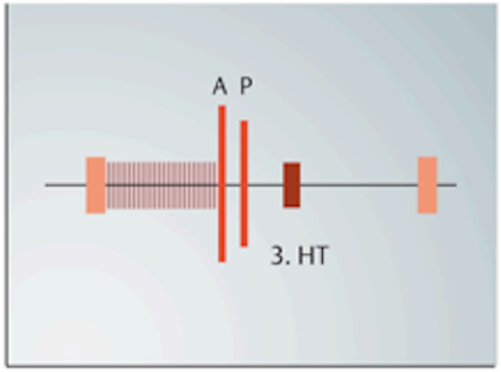
Palpation:
Herz: Hebender lateralisierter Herzspitzenstoss, eventuell systolisches Schwirren
Puls: Häufig unregelmässig wegen VHF

Arterieller Blutdruck:
Normale Amplitude

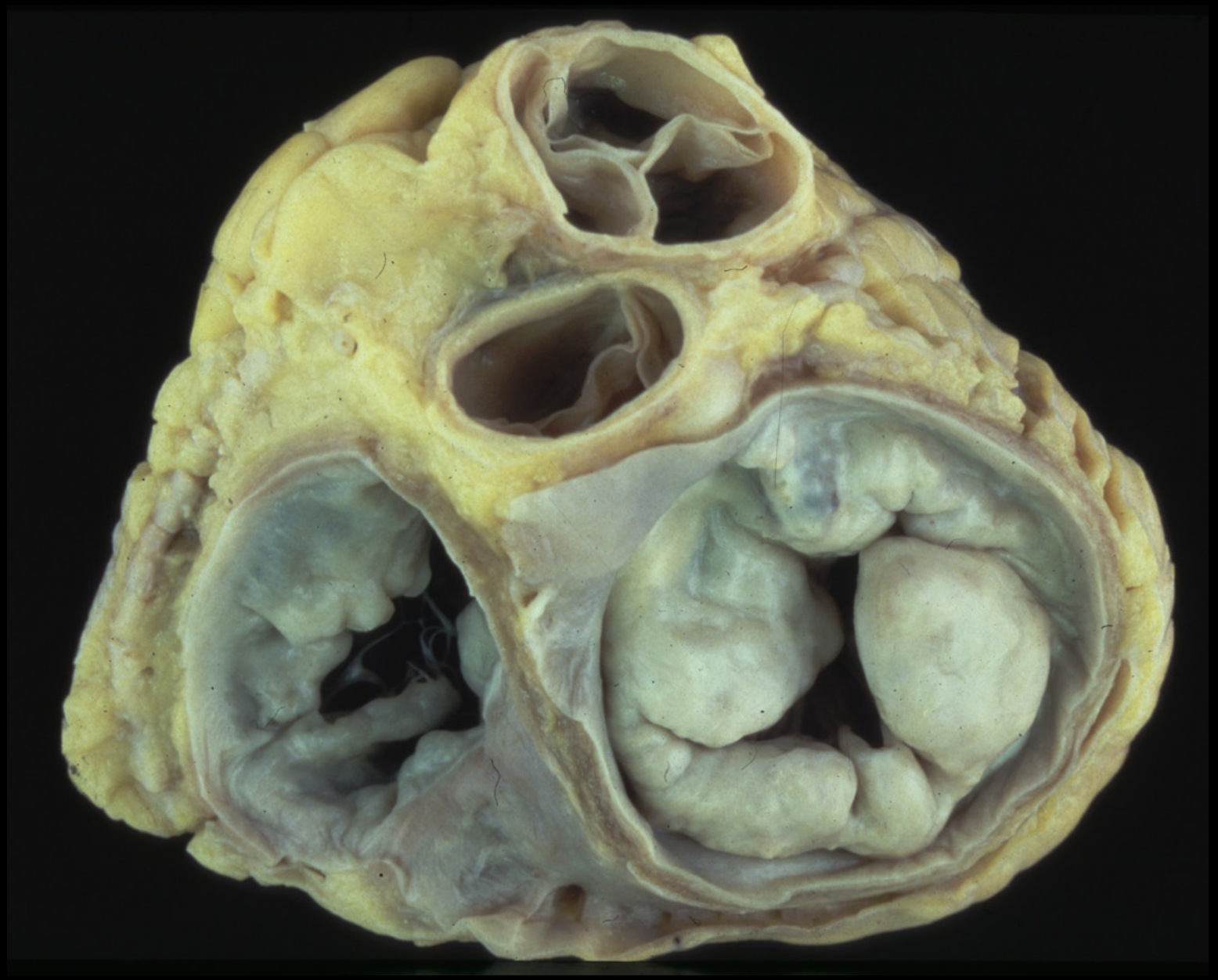
EKG:
Sinusrhythmus (VHF); Linkslage; Linkshypertrophie; Repolarisationsstörung

Mitralinsuffizienz

Untersuchung von Patienten mit MI

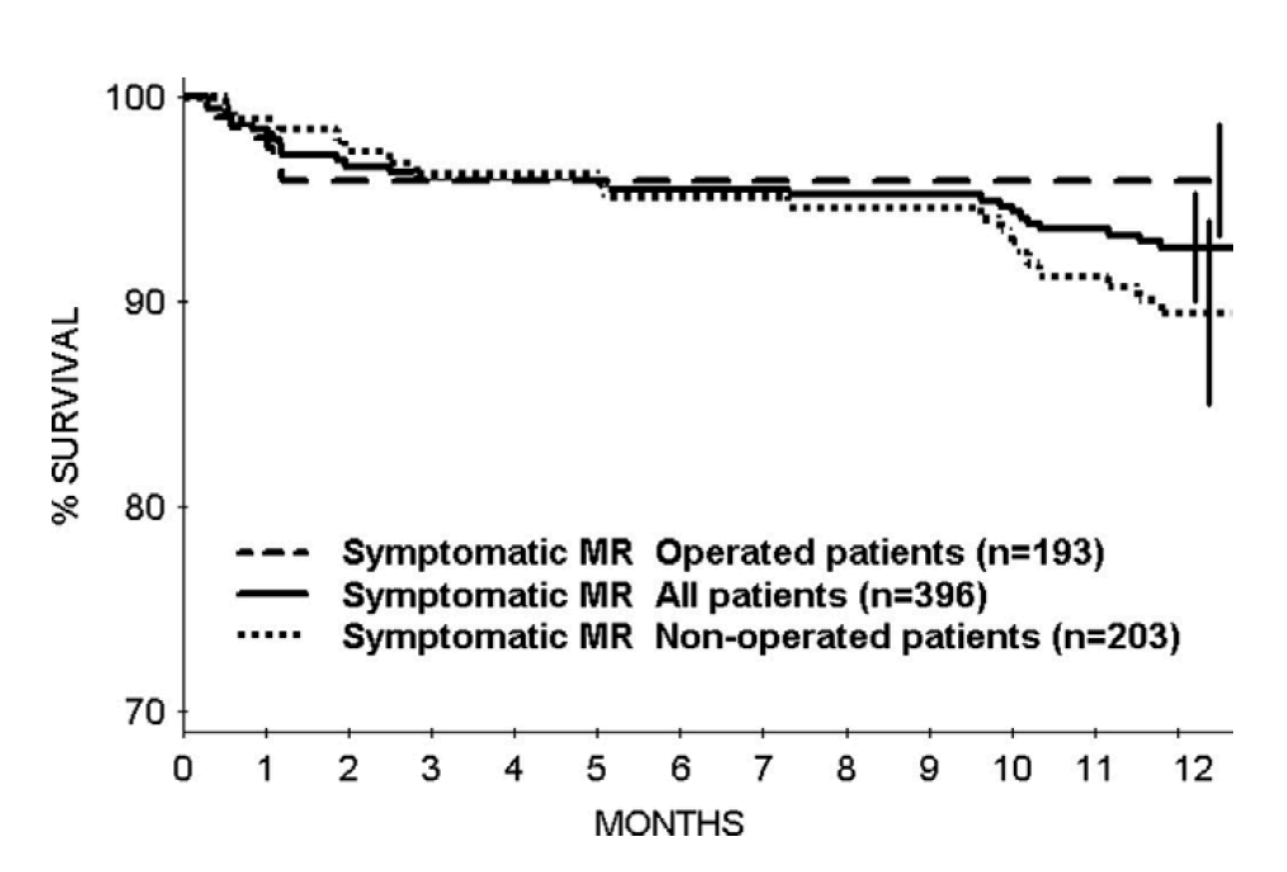
Auskultationsort	Schematische phonokardiografische Darstellung	Key point
 p.m.: Herzspitze		Herztöne: 1. HT leise oder fehlend, 2. HT breit gespalten Extratöne: 3. HT Herzgeräusche: hochfrequentes, holosystolisches, bandförmiges Geräusch

Mitralklappe: Prolaps



Prognose der schweren Mitralinsuffizienz

1-Jahres-Ueberleben von symptomatischen Patienten



90% 1-Jahres-Ueberleben (schwer, symptomatisch, keine Intervention)

Iung et al. Curr Probl Cardiol 2007;32:609-661

Quantifizierung der Mitralinsuffizienz

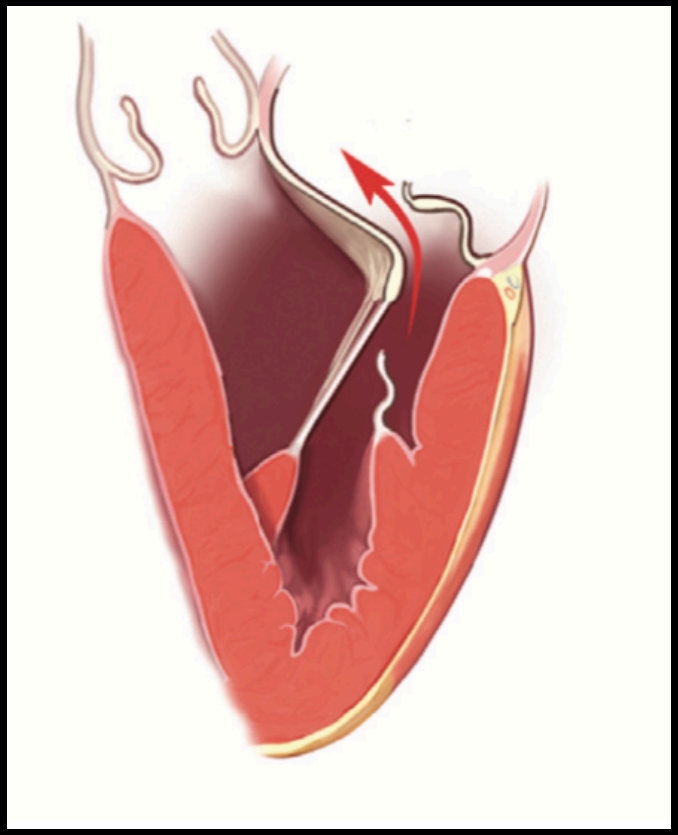
= Kardiologisches Fachwissen

	MR severity*			
	Mild	Moderate		Severe
Structural				
MV morphology	**None or mild leaflet abnormality** (e.g., mild thickening, calcifications or prolapse, mild tenting)	Moderate leaflet abnormality or moderate tenting		**Severe valve lesions** (primary: flail leaflet, ruptured papillary muscle, severe retraction, large perforation; secondary: severe tenting, poor leaflet coaptation)
LV and LA size†	Usually normal	Normal or mild dilated		Dilated‡
Qualitative Doppler				
Color flow jet area§	**Small, central, narrow, often brief**	Variable		Large central jet (>50% of LA) or eccentric wall-impinging jet of variable size
Flow convergence‖	**Not visible, transient or small**	Intermediate in size and duration		**Large throughout systole**
CWD jet	Faint/partial/parabolic	Dense but partial or parabolic		Holosystolic/dense/**triangular**
Semiquantitative				
VCW (cm)	<0.3	Intermediate		≥0.7 (>0.8 for biplane)¶
Pulmonary vein flow#	**Systolic dominance** (may be blunted in LV dysfunction or AF)	Normal or systolic blunting#		Minimal to no systolic flow/ **systolic flow reversal**
Mitral inflow**	**A-wave dominant**	Variable		E-wave dominant (>1.2 m/sec)
Quantitative††,‡‡				
EROA, 2D PISA (cm^2)	<0.20	0.20-0.29	0.30-0.39	≥0.40 (may be lower in secondary MR with elliptical ROA)
RVol (mL)	<30	30-44	45-59††	≥ 60 (may be lower in low flow conditions)
RF (%)	< 30	30-39	40-49	≥50

Zoghby et al. J Am Soc Echocardiogr 2017

Formen der Mitralinsuffizienz

Primäre Mitralinsuffizienz

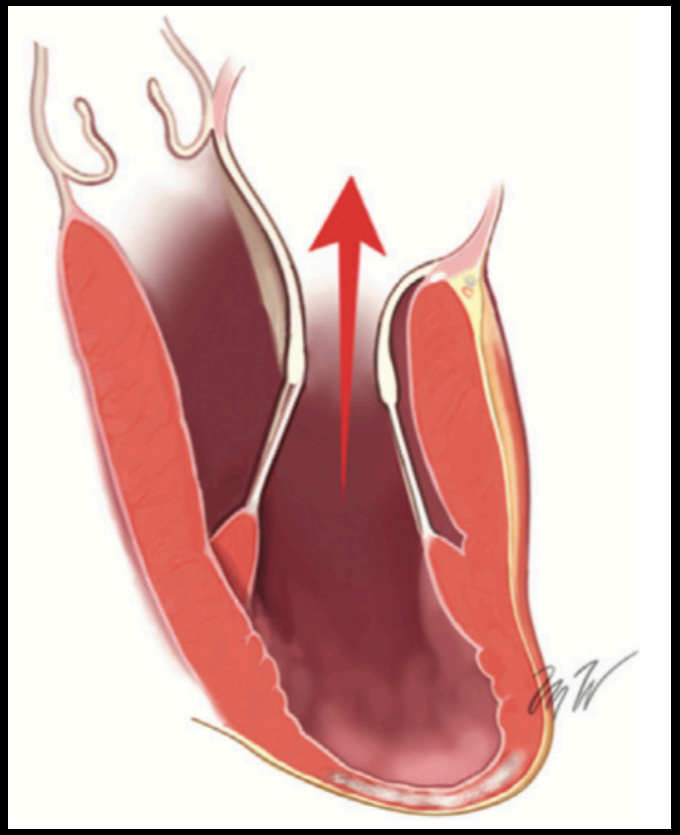


Organisch

⬇

Hauptproblem = Klappe

Sekundäre Mitralinsuffizienz



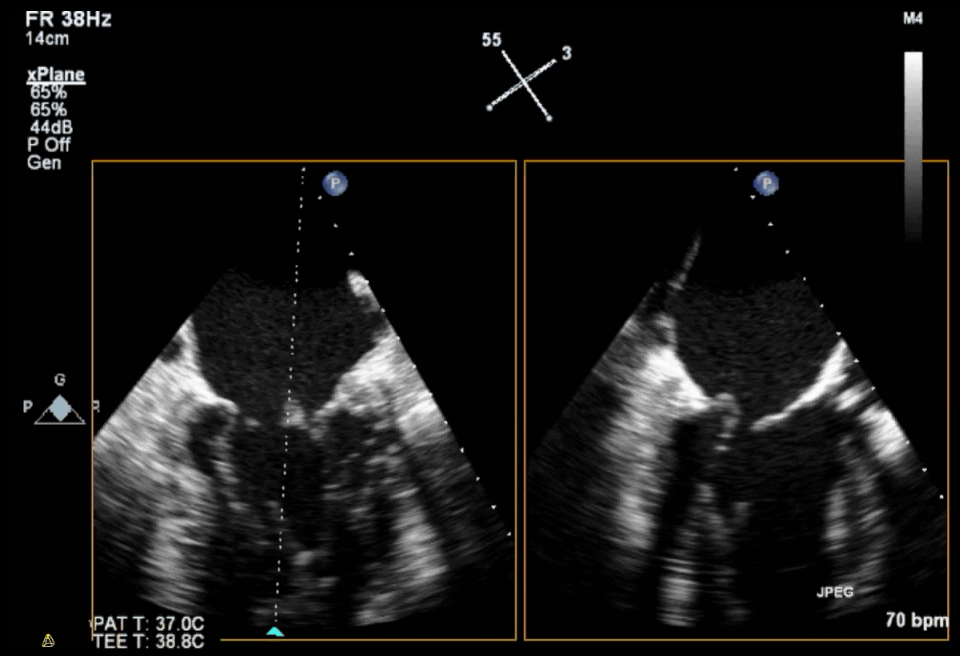
Funktionell

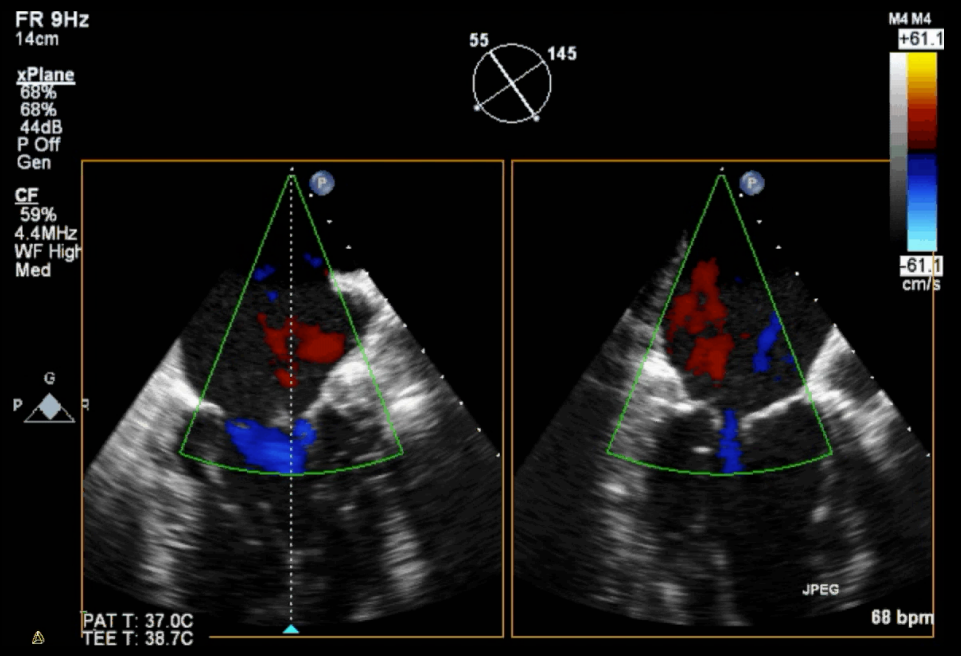
⬇

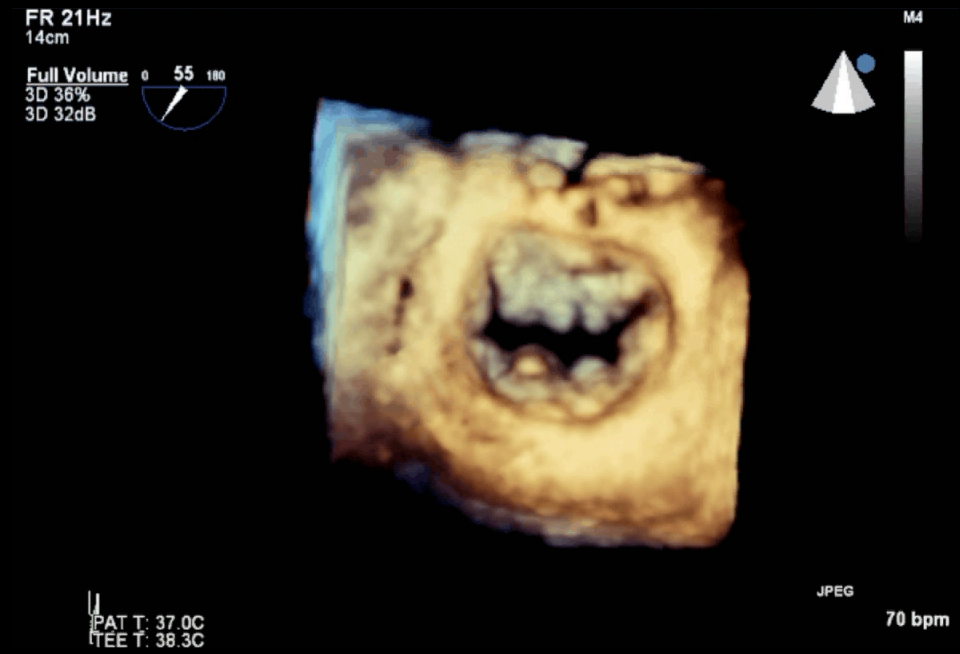
Hauptproblem = Ventrikel

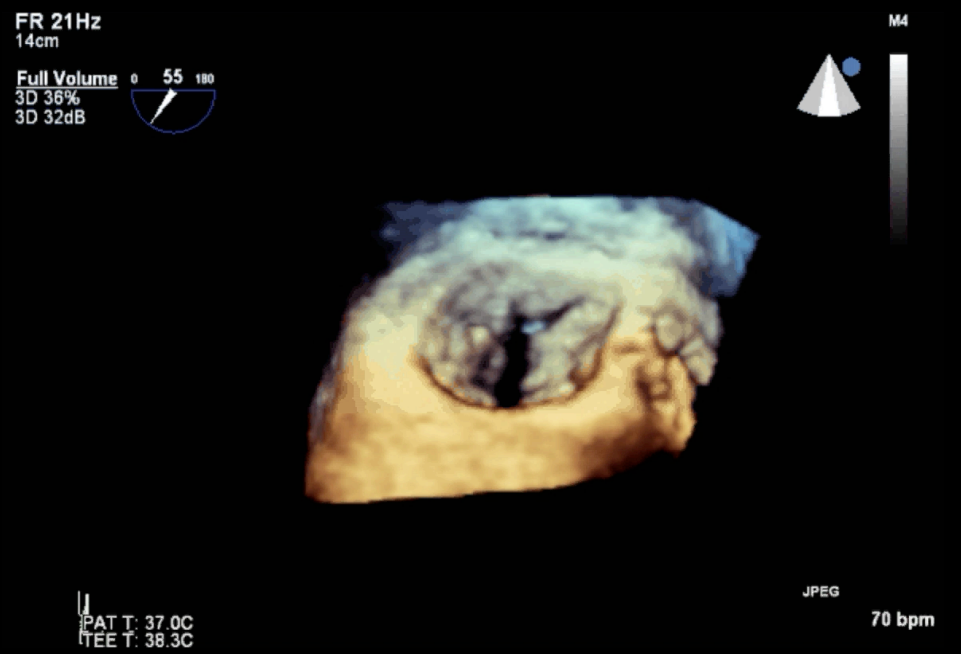
Stone G. et al. J Am Coll Cardiol 2015;66:278-307

Primäre Mitralinsuffizienz









Herzinsuffizienz bei primärer Mitralinsuffizienz

DISEASED MYOCARDIUM		
ARRHYTHMIAS		
ABNORMAL LOADING CONDITIONS		
Hypertension		
Valve and myocardium structural defects	Acquired	Mitral, aortic, tricuspid and pulmonary valve diseases.
	Congenital	Atrial and ventricular septum defects and others (for details see a respective expert document).
Pericardial and endomyocardial pathologies	Pericardial	Constrictive pericarditis Pericardial effusion
	Endomyocardial	HES, EMF, endocardial fibroelastosis.
High output states		Severe anaemia, sepsis, thyrotoxicosis, Paget's disease, arteriovenous fistula, pregnancy.
Volume overload		Renal failure, iatrogenic fluid overload.

Type of HF		HFrEF	HFmrEF	HFpEF
CRITERIA	1	Symptoms ± Signs[a]	Symptoms ± Signs[a]	Symptoms ± Signs[a]
	2	LVEF <40%	LVEF 40–49%	LVEF ≥50%
	3	–	1. Elevated levels of natriuretic peptides[b]; 2. At least one additional criterion: a. relevant structural heart disease (LVH and/or LAE), b. diastolic dysfunction (for details see Section 4.3.2).	1. Elevated levels of natriuretic peptides[b]; 2. At least one additional criterion: a. relevant structural heart disease (LVH and/or LAE), b. diastolic dysfunction (for details see Section 4.3.2).

Ponikowski et al. Eur Heart J 2016;37:2129-2200

Therapie der primären Mitralinsuffizienz

Medikamente

Chronische primäre Mitralinsuffizienz:
Nur zur Therapie der Herzinsuffizienz wenn keine Intervention/Operation
Akute primäre Mitralinsuffizienz:
Nitrate und Diuretika

Intervention

Wenn möglich Clipping
Andere Methoden haben noch keine breite Akzeptanz
Patienten mit hohem chirurgischem Risiko oder inoperabel

Operation

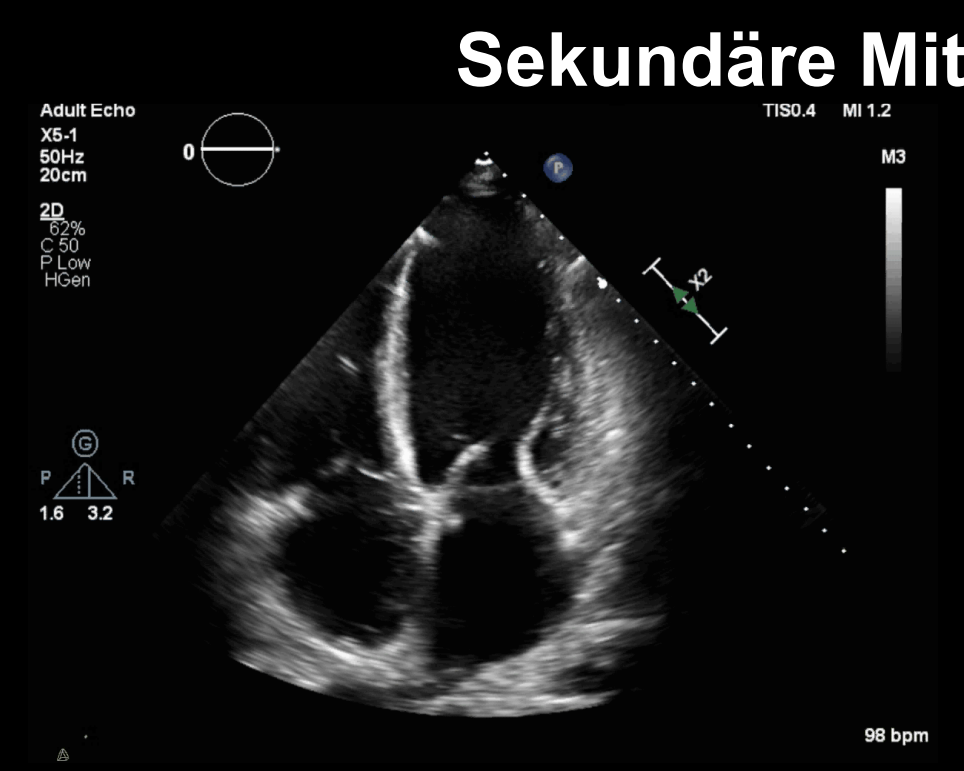
Wenn möglich Rekonstruktion
Ersatz hat schlechtere Langzeitergebnisse
Erfahrenes Zentrum je nach echokardiographischem Befund

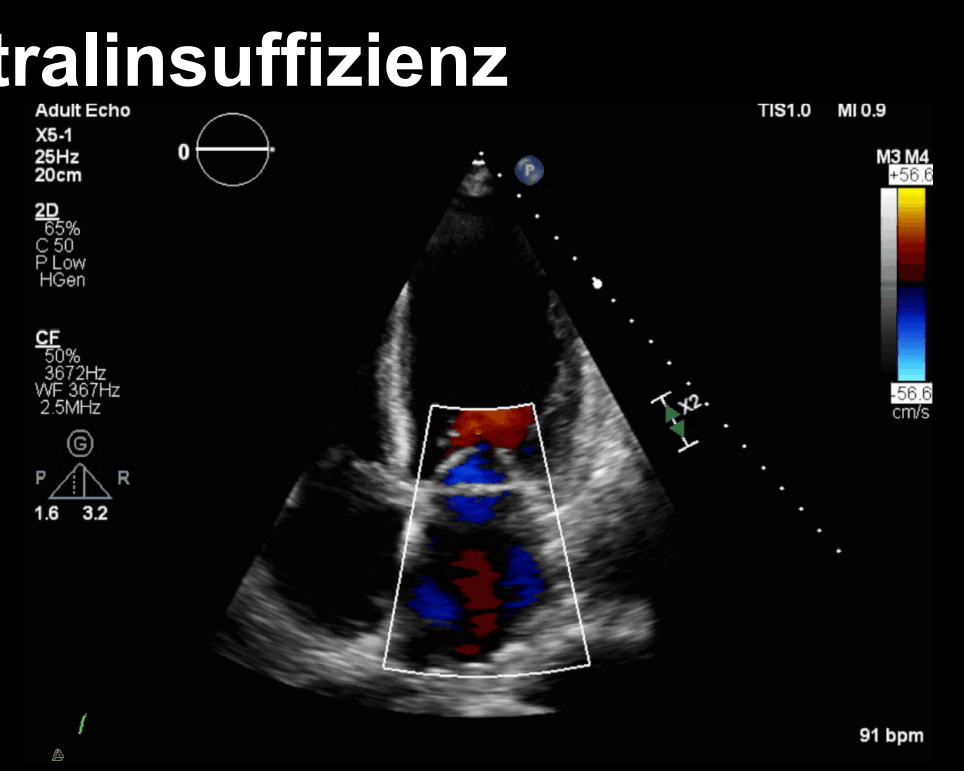
Baumgartner H. et al. Eur Heart J 2017;38:2739-2786

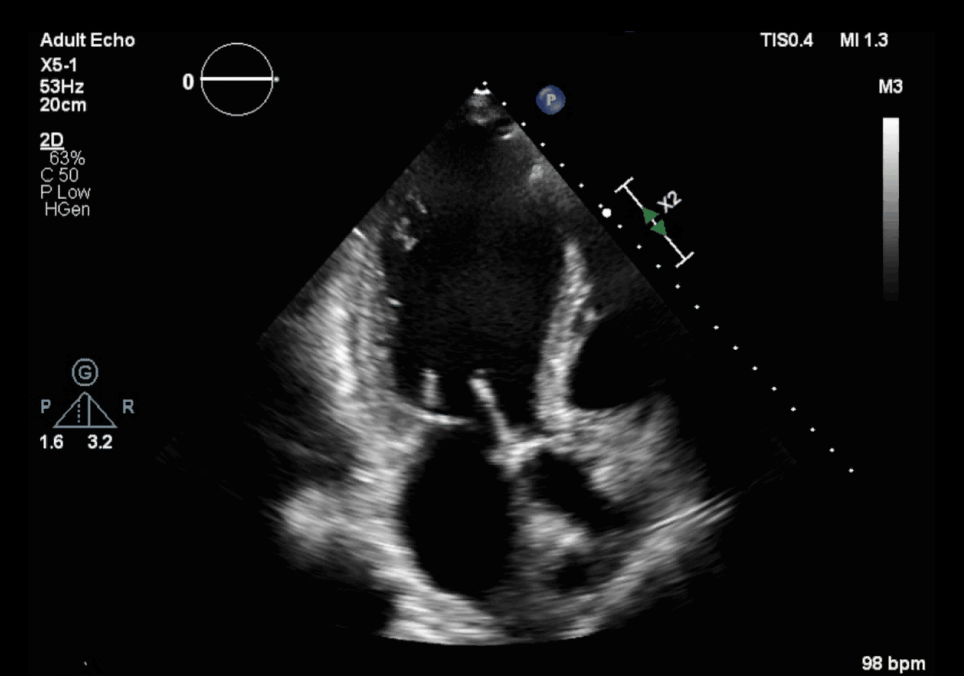
Mitralinsuffizienz und medikamentöse Therapie

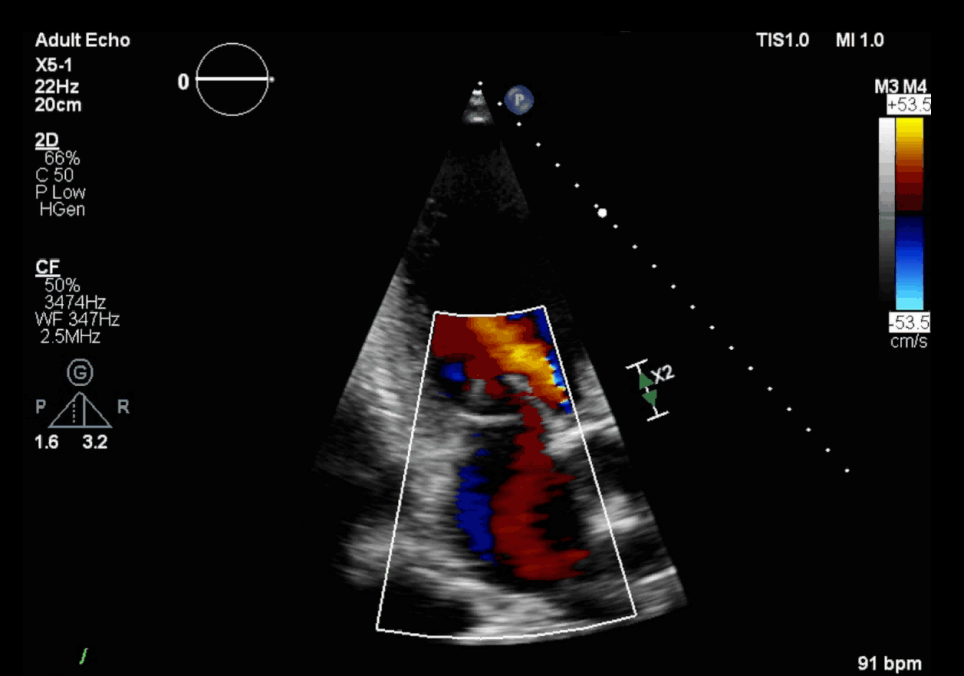
- Betablocker: keine guten Daten
- Diuretika, Nitrate: kontroverse Daten
  Ausgenommen: akute Mitralinsuffizienz
- Arterielle Hypertonie behandeln
- Gegebenenfalls Herzinsuffizienz behandeln
- Antikoagulation:
  - bei VHF und bei Thrombus im LA
  - für 3 Monate nach MKR

Sekundäre Mitralinsuffizienz









Herzinsuffizienz bei sekundärer Mitralinsuffizienz

DISEASED MYOCARDIUM		
ARRHYTHMIAS		
ABNORMAL LOADING CONDITIONS		
Hypertension		
Valve and myocardium structural defects	Acquired	Mitral, aortic, tricuspid and pulmonary valve diseases.
	Congenital	Atrial and ventricular septum defects and others (for details see a respective expert document).
Pericardial and endomyocardial pathologies	Pericardial	Constrictive pericarditis Pericardial effusion
	Endomyocardial	HES, EMF, endocardial fibroelastosis.
High output states		Severe anaemia, sepsis, thyrotoxicosis, Paget's disease, arteriovenous fistula, pregnancy.
Volume overload		Renal failure, iatrogenic fluid overload.

Type of HF		HFrEF	HFmrEF	HFpEF
CRITERIA	1	Symptoms ± Signs[a]	Symptoms ± Signs[a]	Symptoms ± Signs[a]
	2	LVEF <40%	LVEF 40–49%	LVEF ≥50%
	3	–	1. Elevated levels of natriuretic peptides[b]; 2. At least one additional criterion: a. relevant structural heart disease (LVH and/or LAE), b. diastolic dysfunction (for details see Section 4.3.2).	1. Elevated levels of natriuretic peptides[b]; 2. At least one additional criterion: a. relevant structural heart disease (LVH and/or LAE), b. diastolic dysfunction (for details see Section 4.3.2).

Ponikowski et al. Eur Heart J 2016;37:2129-2200

Therapie der sekundären Mitralinsuffizienz

Medikamente

Essentiell

Optimale medikamentöse Therapie der Herzinsuffizienz
Zusätzlich:
Resynchronisation und Revaskularisation

Intervention

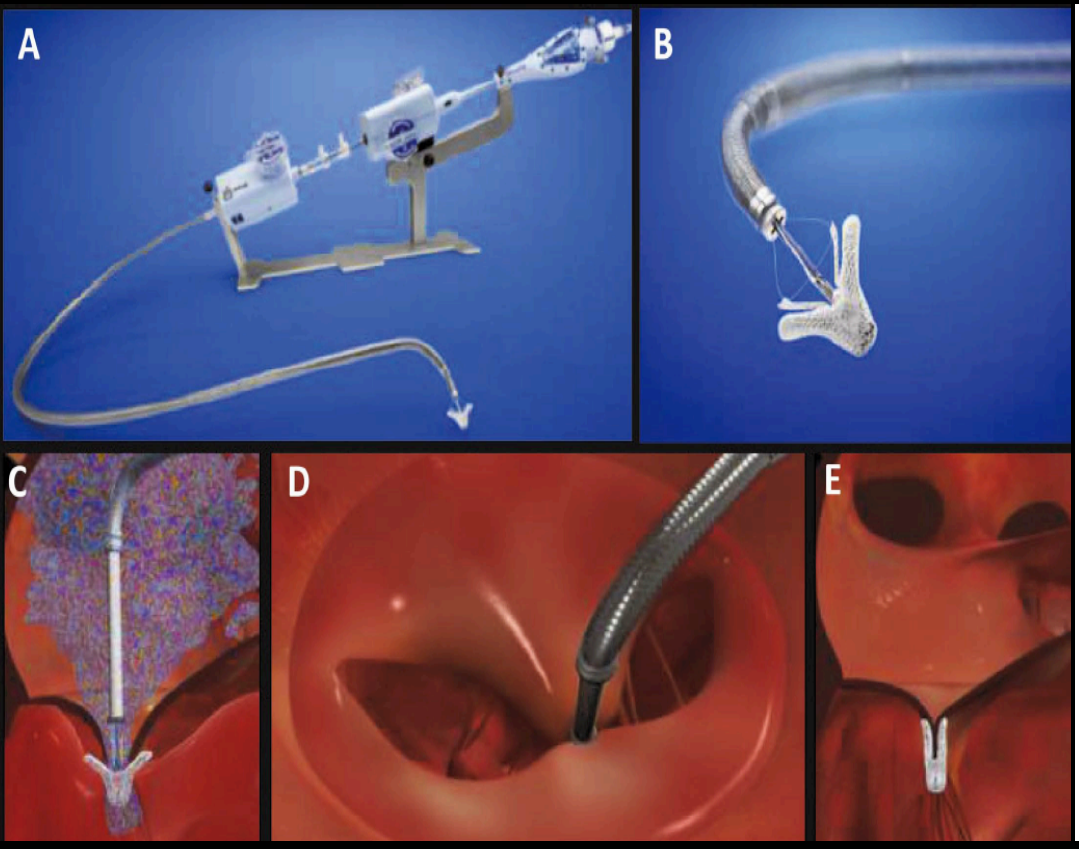
Wenn möglich Clipping
Andere Methoden haben noch keine breite Akzeptanz
Möglichkeit der symptomatischen Verbesserung

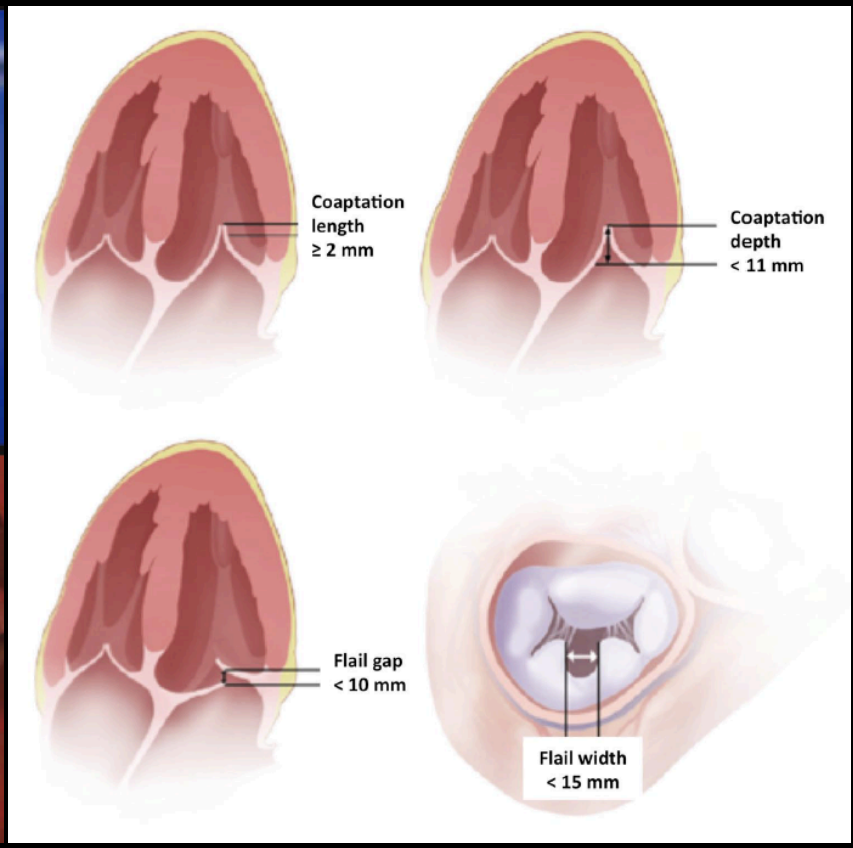
Operation

Rekonstruktion oder Ersatz je nach echokardiographischem Bild
Indikation vor allem bei gleichzeitiger ACBP-Operation
Möglichkeit der symptomatischen Verbesserung

Baumgartner H. et al. Eur Heart J 2017;38:2739-2786

Mitralinsuffizienz und perkutane Rekonstruktion

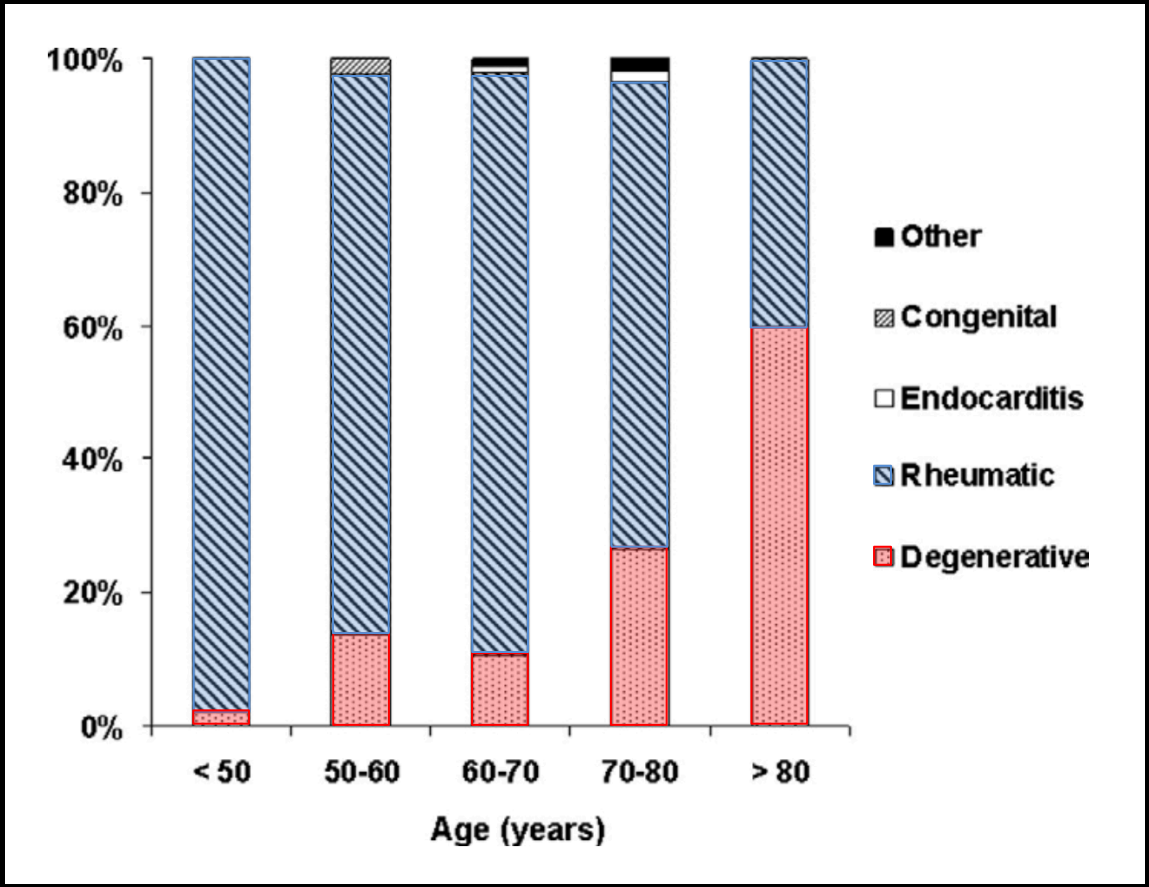




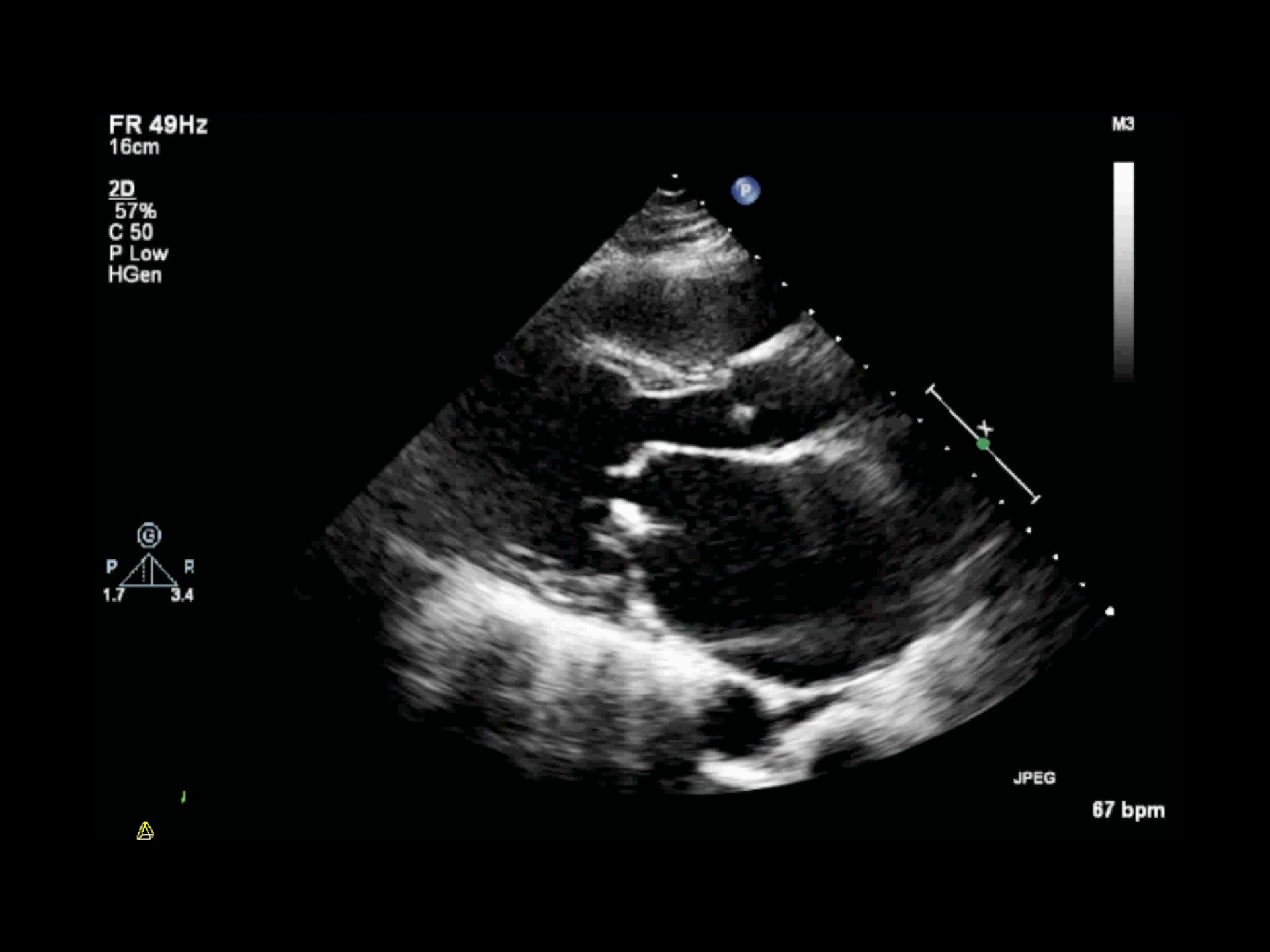
De Bonis et al. Nat Rev Cardiol 2012;9:133-146

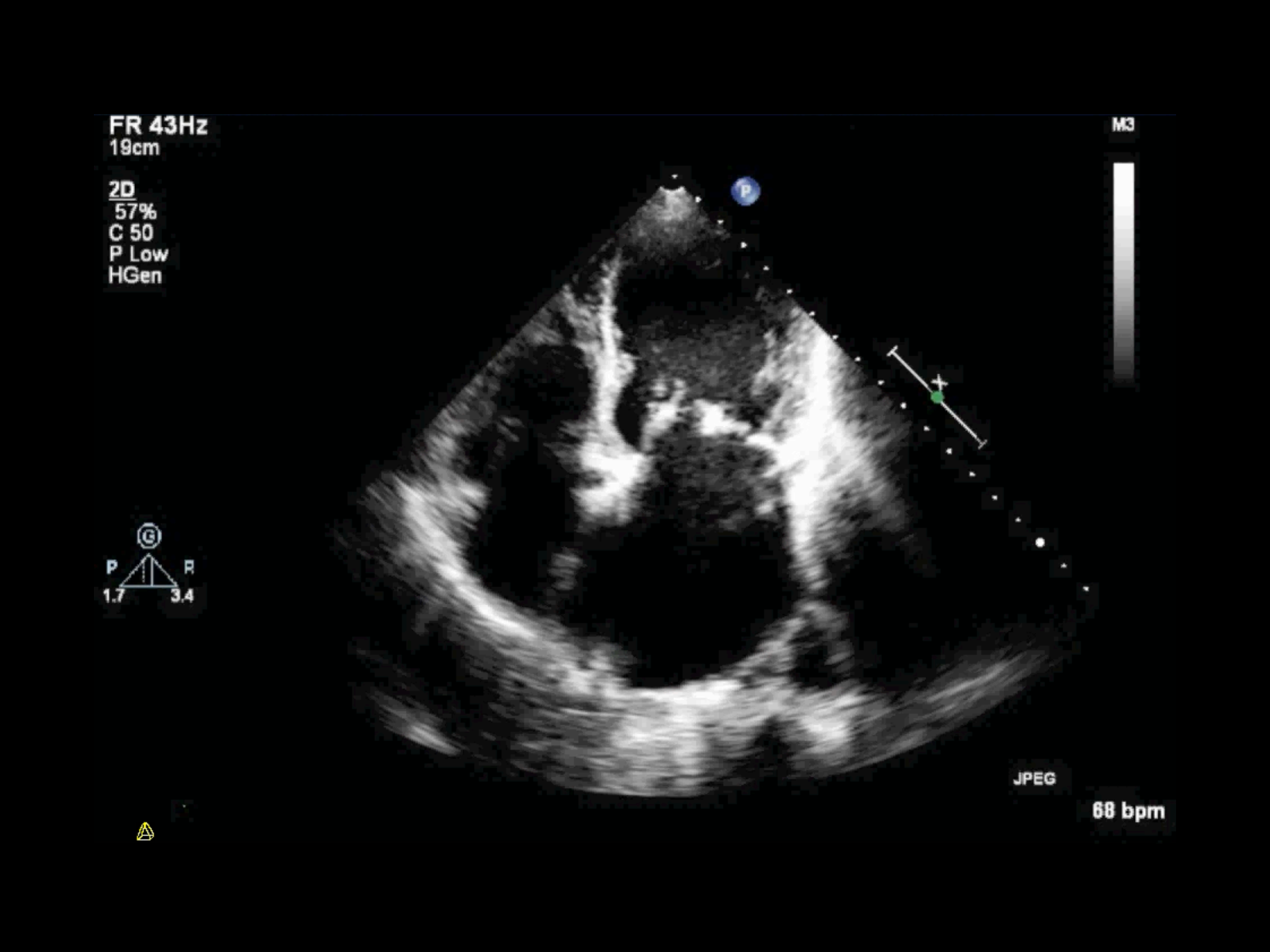
Ursachen der Mitralstenose

Verteilung der Ursachen nach Alter



Iung et al. Curr Probl Cardiol 2007;32:609-661


FR 49Hz
16cm
2D
57%
C 50
P Low
HGen
M3
P
G
P
R
1.7
3.4
JPEG
67 bpm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2D
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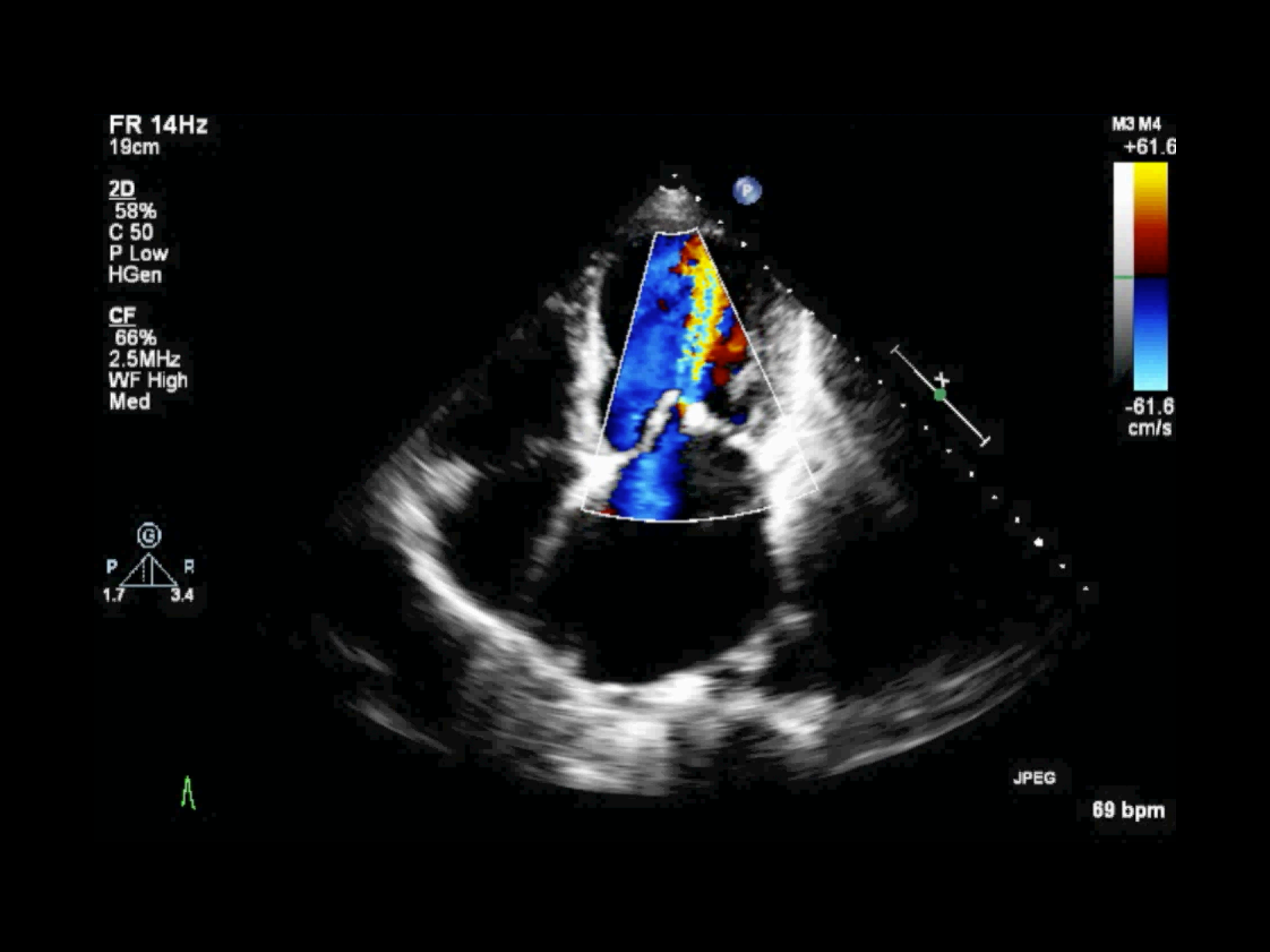
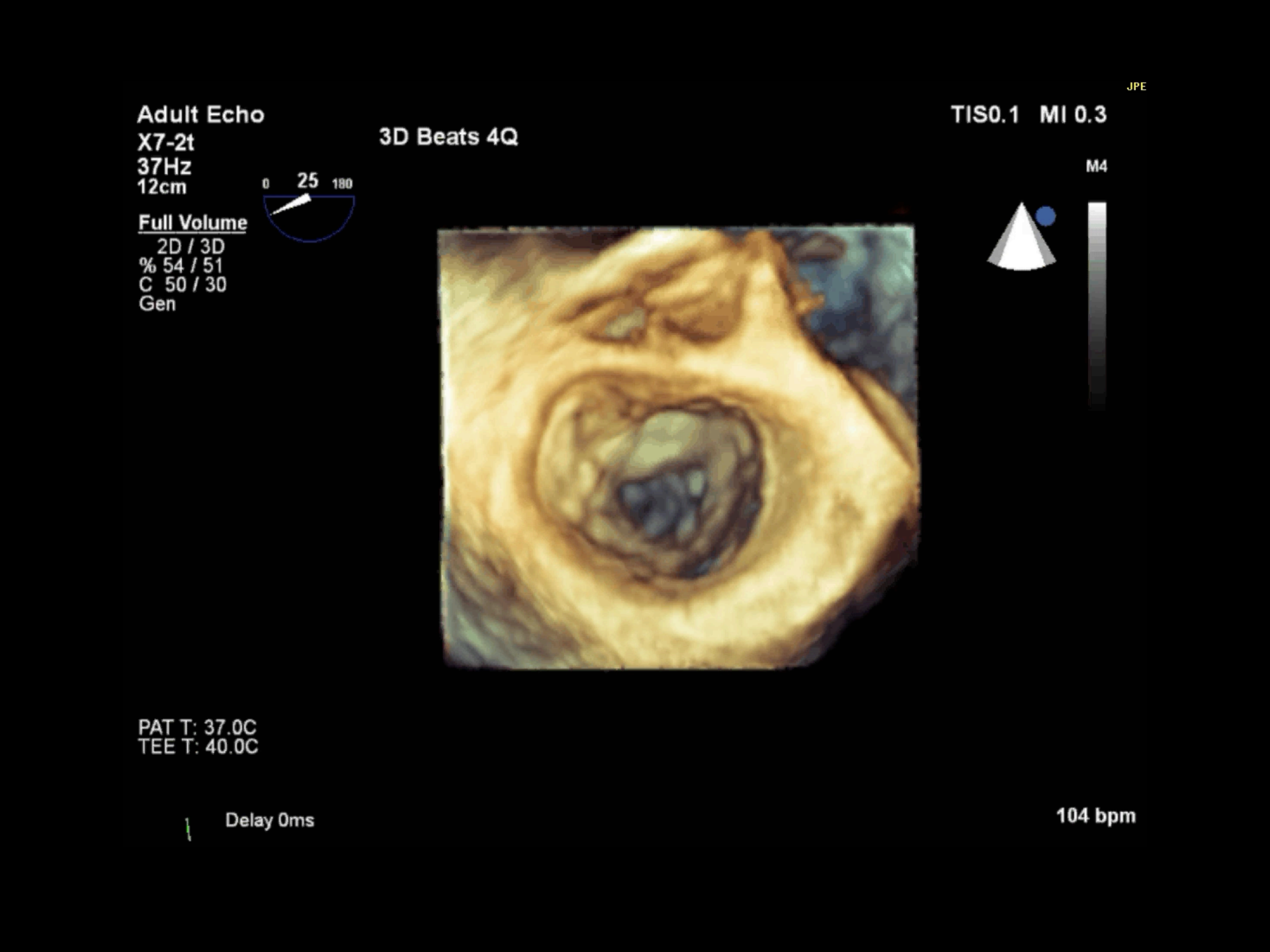
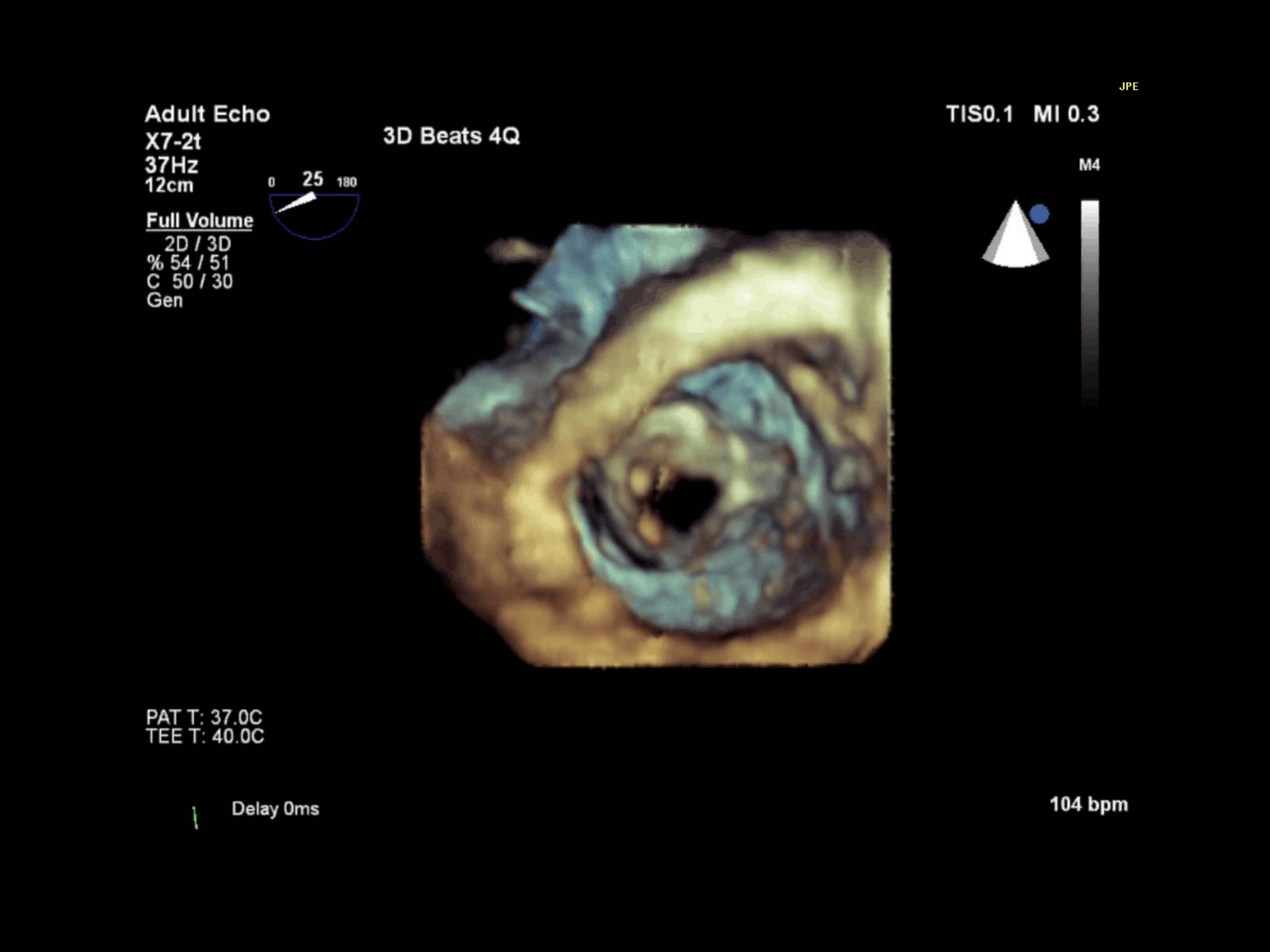
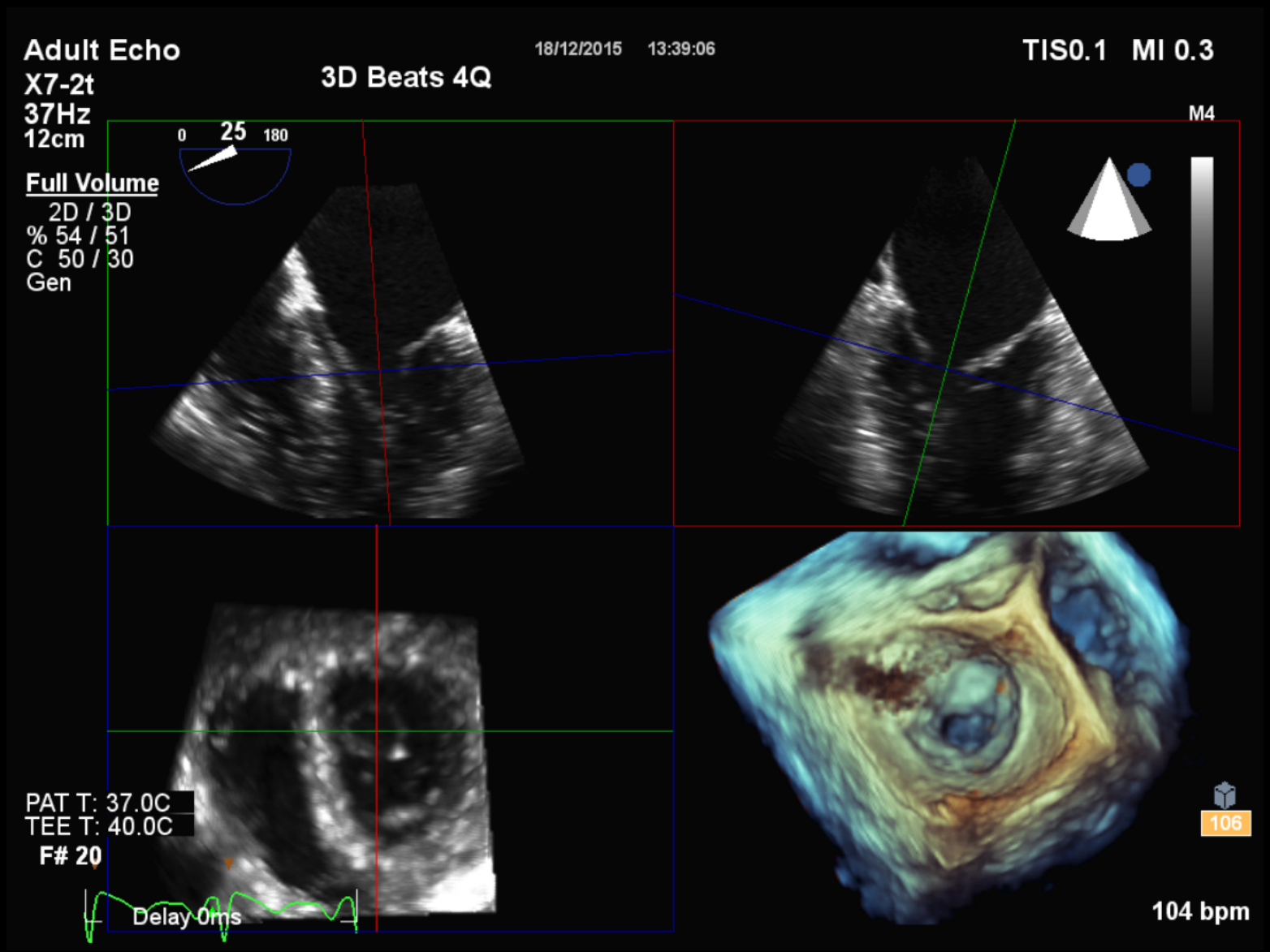
C 50
P Low
HGen
M3
P
G
P
R
1.7
3.4
JPEG
68 bpm

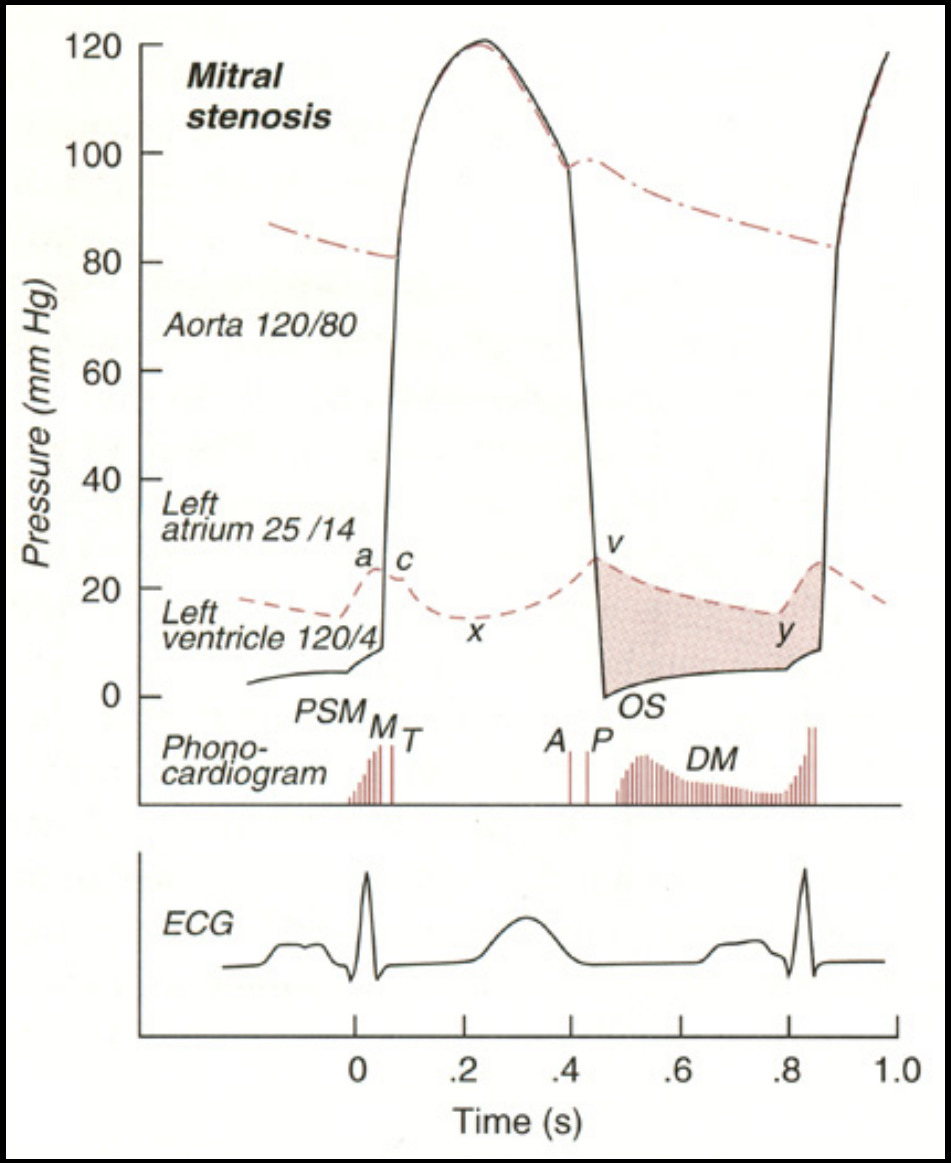

FR 14Hz
19cm
2D
58%
C 50
P Low
HGen
CF
66%
2.5MHz
WF High
Med
M3 M4
+61.6
-61.6
cm/s
P
R
1.7
3.4
JPEG
69 bpm

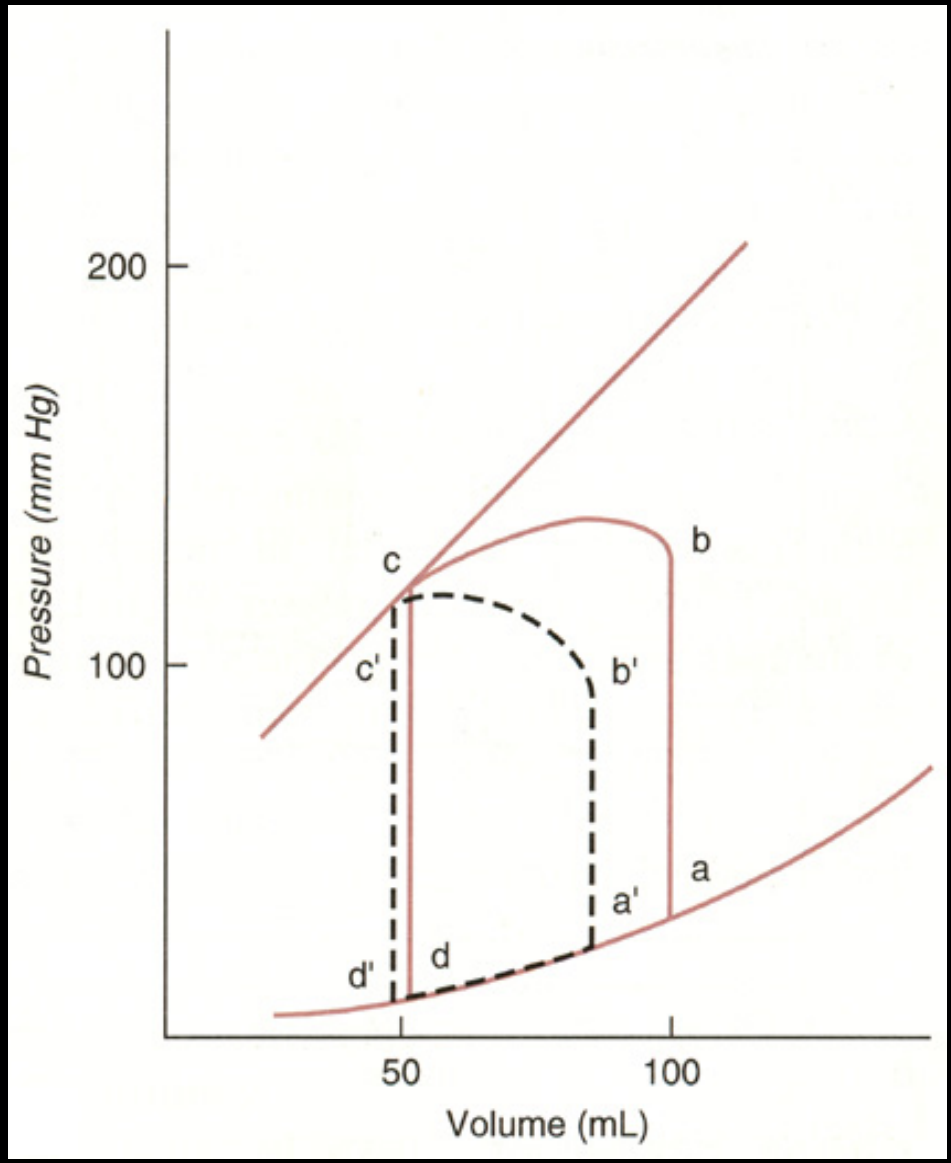

JPE
Adult Echo
X7-2t
37Hz
12cm
0
25
180
Full Volume
2D / 3D
% 54 / 51
C 50 / 30
Gen
3D Beats 4Q
TIS0.1 MI 0.3
M4
PAT T: 37.0C
TEE T: 40.0C
Delay 0ms
104 bpm


Adult Echo
X7-2t
37Hz
12cm
0
25
180
Full Volume
2D / 3D
% 54 / 51
C 50 / 30
Gen
3D Beats 4Q
JPE
TIS0.1 MI 0.3
M4
PAT T: 37.0C
TEE T: 40.0C
Delay 0ms
104 bpm

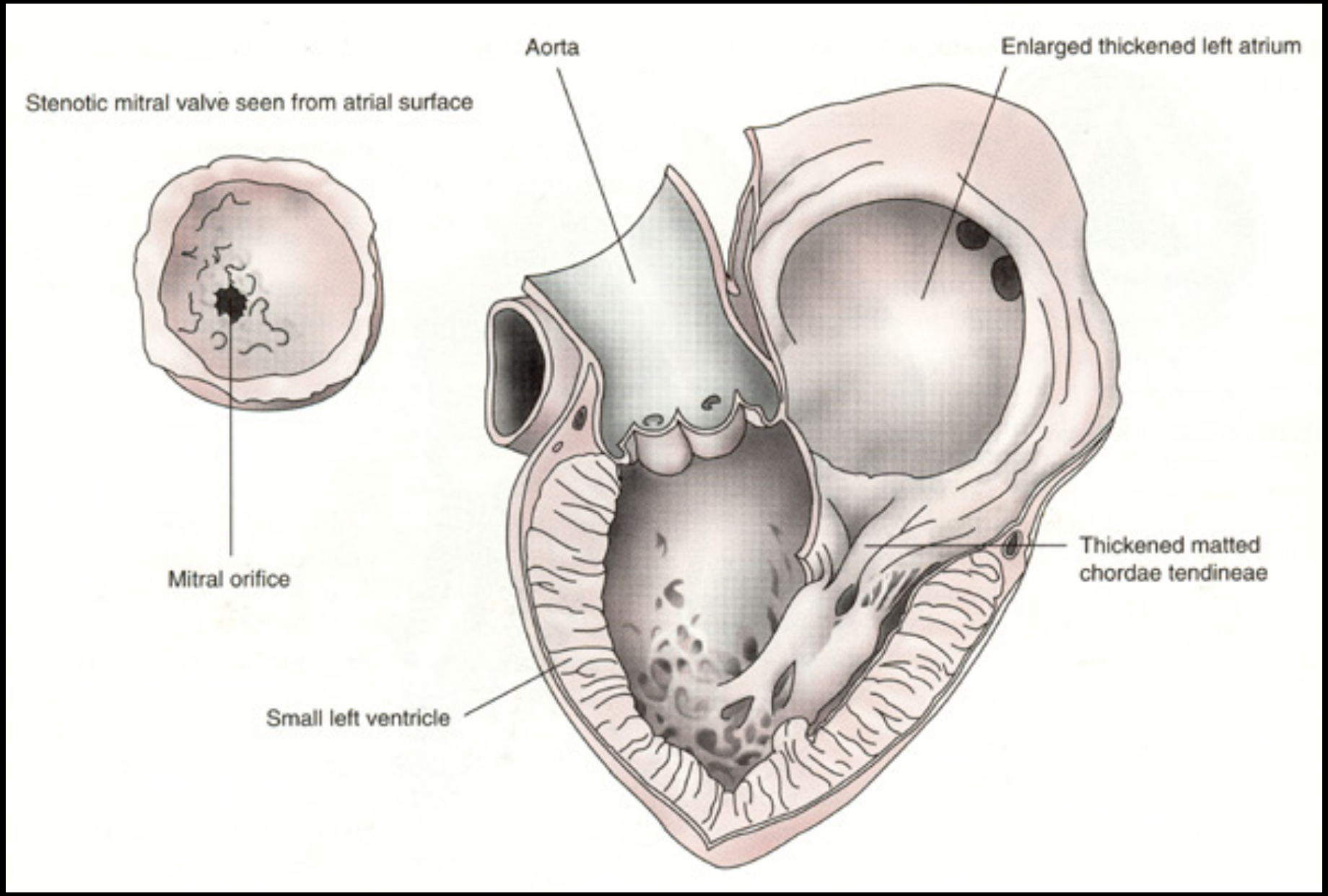

Adult Echo
X7-2t
37Hz
12cm
18/12/2015 13:39:06
3D Beats 4Q
TIS0.1 MI 0.3
M4
0 25 180
Full Volume
2D / 3D
% 54 / 51
C 50 / 30
Gen
PAT T: 37.0C
TEE T: 40.0C
F# 20
Delay 0ms
106
104 bpm

Hämodynamik der Mitralstenose





Folgen der Mitralstenose



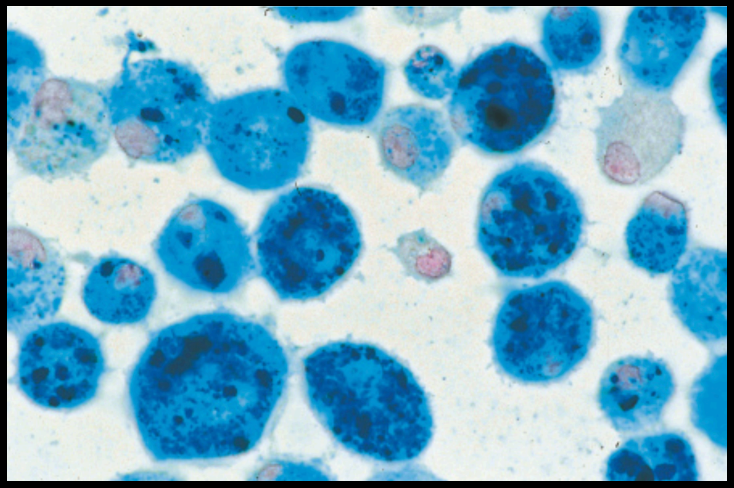
Mitralstenose und kardiale Funktion

Linker Vorhof:

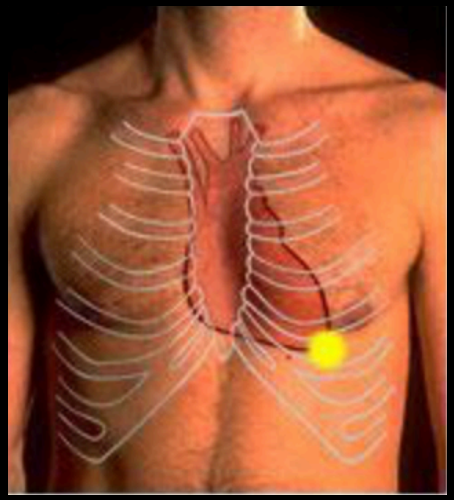
Progressive Dilatation
Atriale Arrhythmien
Atriale Thromben
Embolische Ereignisse

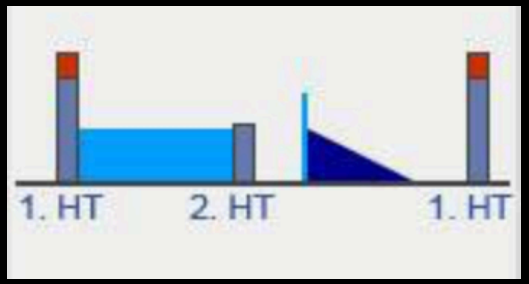
Sekundäre pulmonale Hypertonie:

Hämoptyse (‘Herzfehlerzellen‘)
Lungenödem
Rechtsherzbelastung



Mitralstenose





1: paukend
2: normal
Mesodiastolisches Geräusch, Decrescendo, rumpelnd
Ausstrahlung in Axilla, v. a. in Linksseitenlage
Häufig mit protodiastolischem Click (MOET)
Häufig kombiniert mit Mitralinsuffizienz

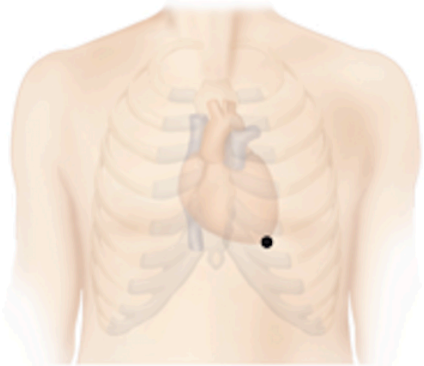
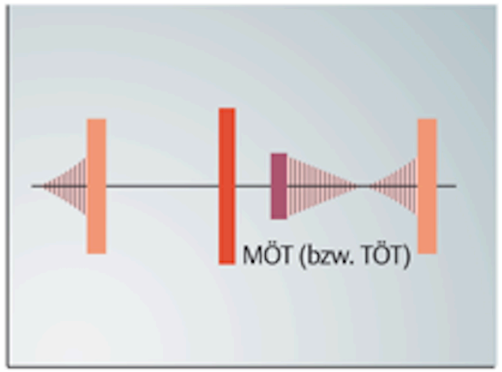
Palpation:
Herz: Eventuell Zeichen der Rechtsherzbelastung
Puls: Häufig unregelmässig wegen VHF

Arterieller Blutdruck:
Normale Amplitude

EKG:
Sinusrhythmus (VHF); Vorhofbelastung; Repolarisationsstörung

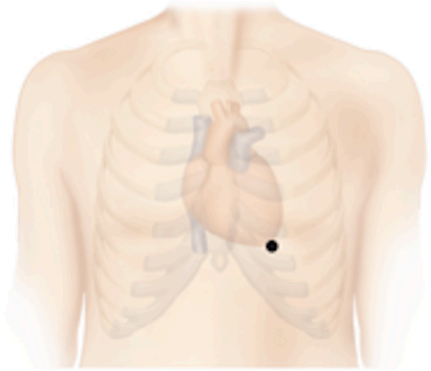
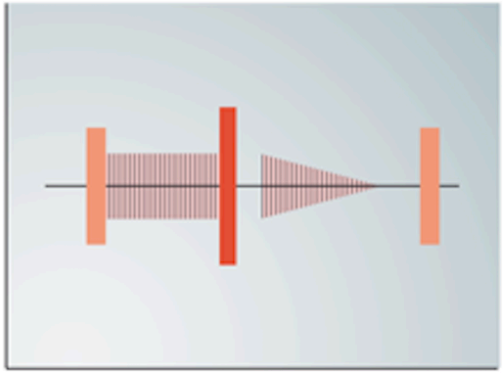
Mitralstenose

Untersuchung von Patienten mit MS

Auskultationsort	Schematische phonokardiografische Darstellung	Key point
 p.m.: Herzspitze	 1. HT 2. HT 1. HT	Herztöne: paukender 1. HT und MÖT bei MS, evtl. TÖT bei TS Extratöne: keine Herzgeräusche: tieffrequentes, diastolisches Decrescendo-geräusch, evtl. Präsystolikum

Kombiniertes Mitralvitium

Untersuchung von Patienten mit MI/MS

Auskultationsort	Schematische phonokardiografische Darstellung	Key point
 p.m.: Herzspitze	 1. HT 2. HT 1. HT	Herztöne: paukender 1. HT Extratöne: keine Herzgeräusche: *Systole*: hochfrequentes, holosystolisches bandförmiges Geräusch *Diastole*: tieffrequentes, mesodiastolisches Decrescendo

Quantifizierung der Mitralstenose

= Kardiologisches Fachwissen

	Mitral Stenosis		
	Mild	Moderate	Severe
Mean gradient (mm Hg)*	Less than 5	5–10	Greater than 10
Pulmonary artery systolic pressure (mm Hg)	Less than 30	30–50	Greater than 50
Valve area (cm^2)	Greater than 1.5	1.0–1.5	Less than 1.0

Grade	*Mobility*	*Subvalvar thickening*	*Thickening*	*Calcification*
1	Highly mobile valve with only leaflet tips restricted	Minimal thickening just below the mitral leaflets	Leaflets near normal in thickness (4–5 mm)	A single area of increased echo brightness
2	Leaflet mid and base portions have normal mobility	Thickening of chordal structures extending up to one third of the chordal length	Mid-leaflets normal, considerable thickening of margins (5–8 mm)	Scattered areas of brightness confined to leaflet margins
3	Valve continues to move forward in diastole, mainly from the base	Thickening extending to the distal third of the chords	Thickening extending through the entire leaflet (5–8 mm)	Brightness extending into the mid-portion of the leaflets
4	No or minimal forward movement of the leaflets in diastole	Extensive thickening and shortening of all chordal structures extending down to the papillary muscles	Considerable thickening of all leaflet tissue (> 8–10 mm)	Extensive brightness throughout much of the leaflet tissue

The total echocardiographic score was derived from an analysis of mitral leaflet mobility, valvar and subvalvar thickening, and calcification which were graded from 0 to 4 according to the above criteria. This gave a total score of 0 to 16.

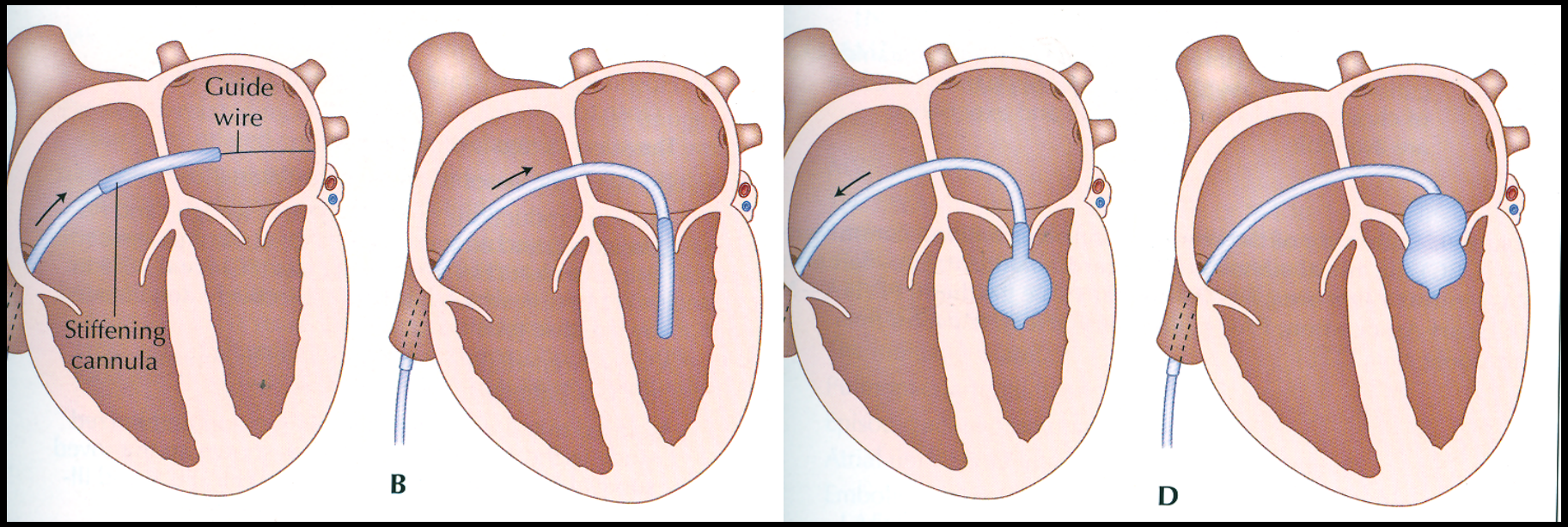
Mitralstenose und medikamentöse Therapie

- **Betablocker, Calciumantagonisten**
  ➔ Verlangsamung der HF
- **Diuretika, Nitrate**
  ➔ Vorlastsenkung
- **Antikoagulation**
  - VHF
  - St. n. Embolie
  - Thrombus /Spontankontrast im LA
  - LA-Dilatation (>60 ml/m2)

Therapie der schweren Mitralstenose

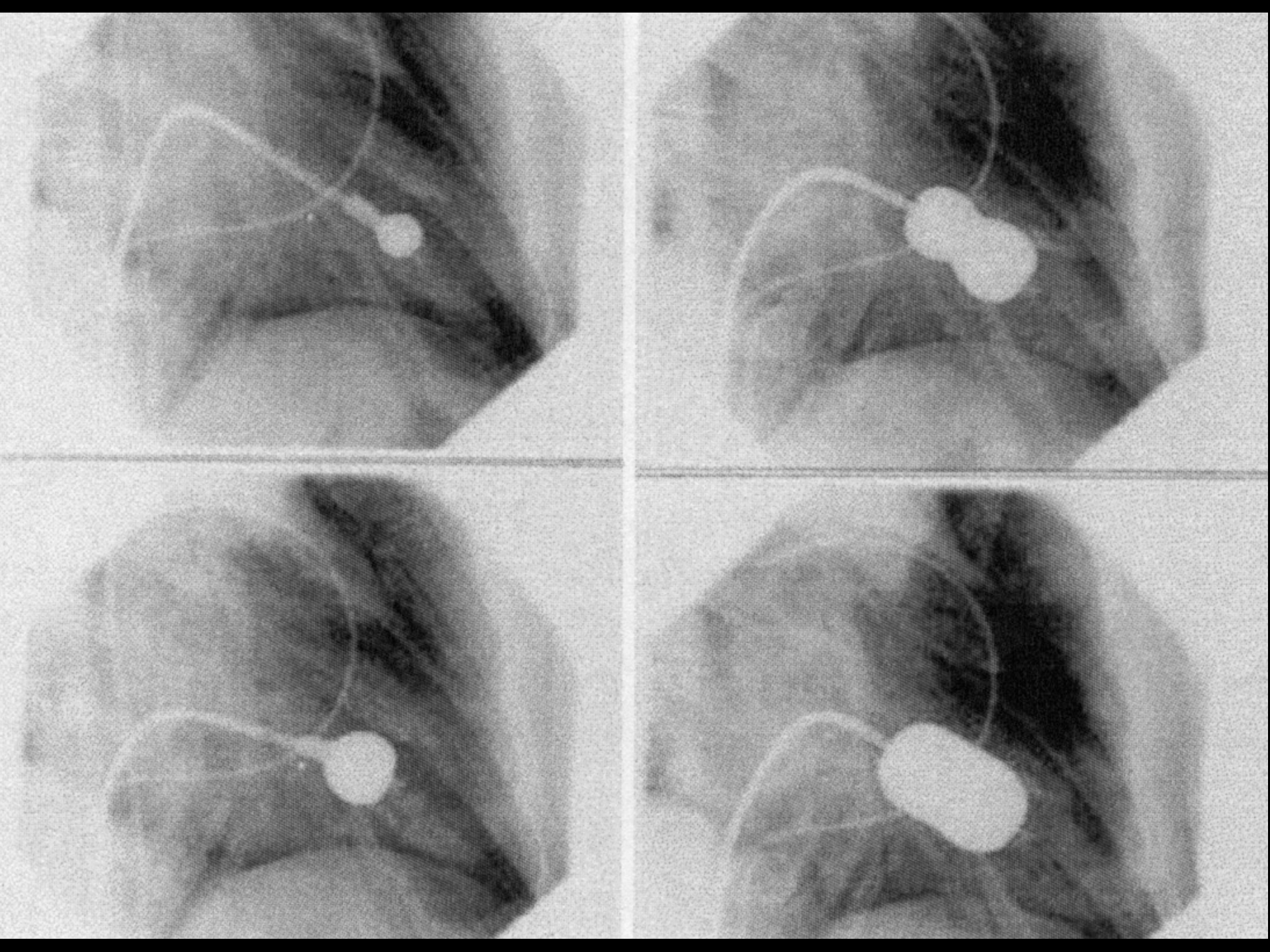
- Valvuloplastie
- Kommissurotomie
- Klappenersatz

Mitralklappen-Valvuloplastie

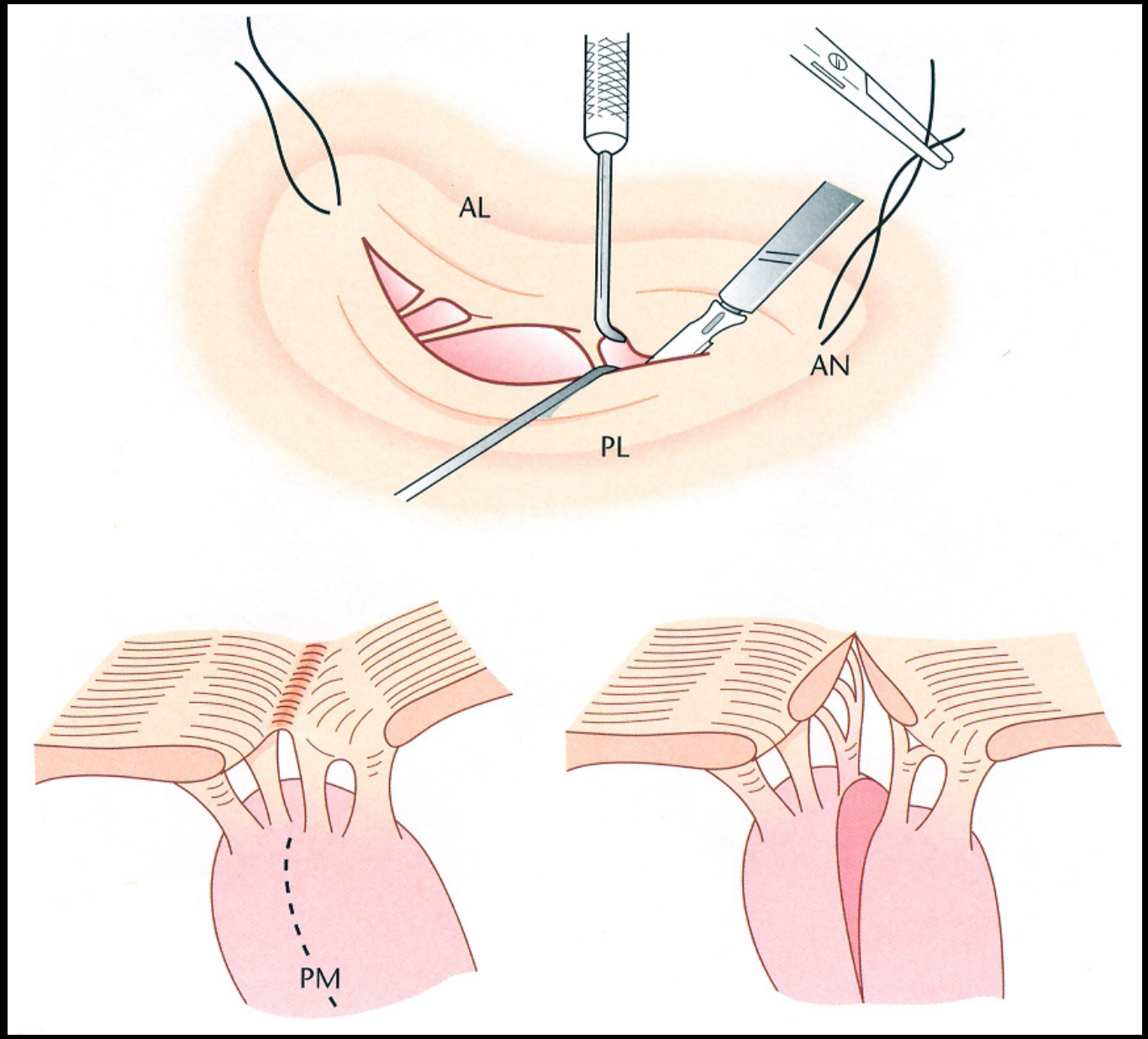


Contra-indications
Mitral valve area >1.5 cm^{2a}
Left atrial thrombus
More than mild mitral regurgitation
Severe or bi-commissural calcification
Absence of commissural fusion
Severe concomitant aortic valve disease, or severe combined tricuspid stenosis and regurgitation requiring surgery
Concomitant CAD requiring bypass surgery

©ESC 2017

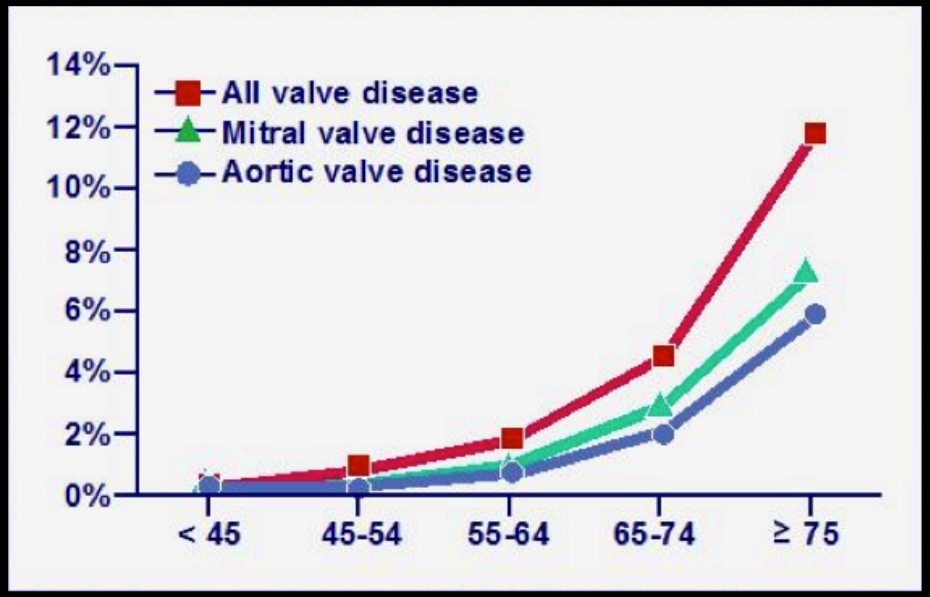


Mitralklappen-Kommissurotomie

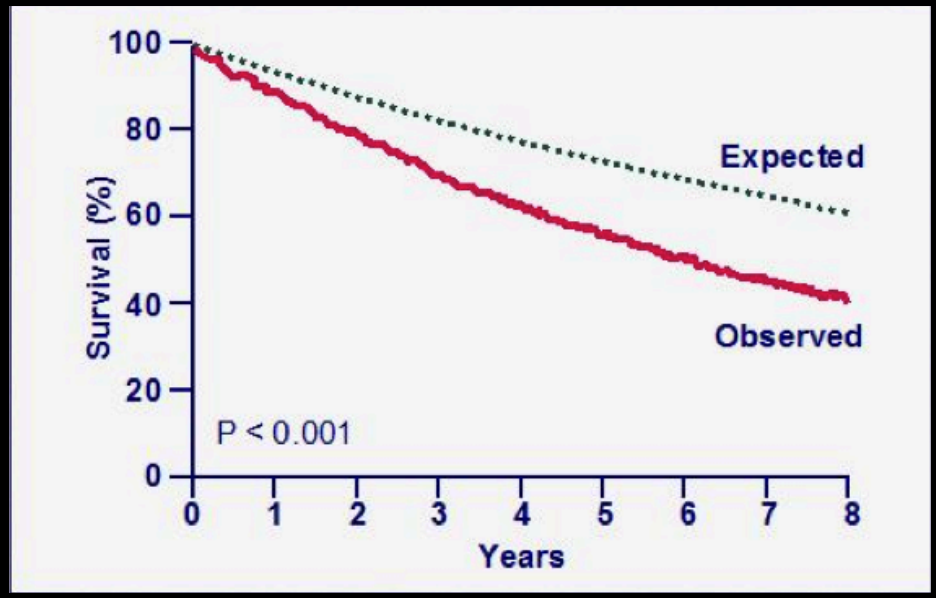


Klappenerkrankungen

Prävalenz



Prognose



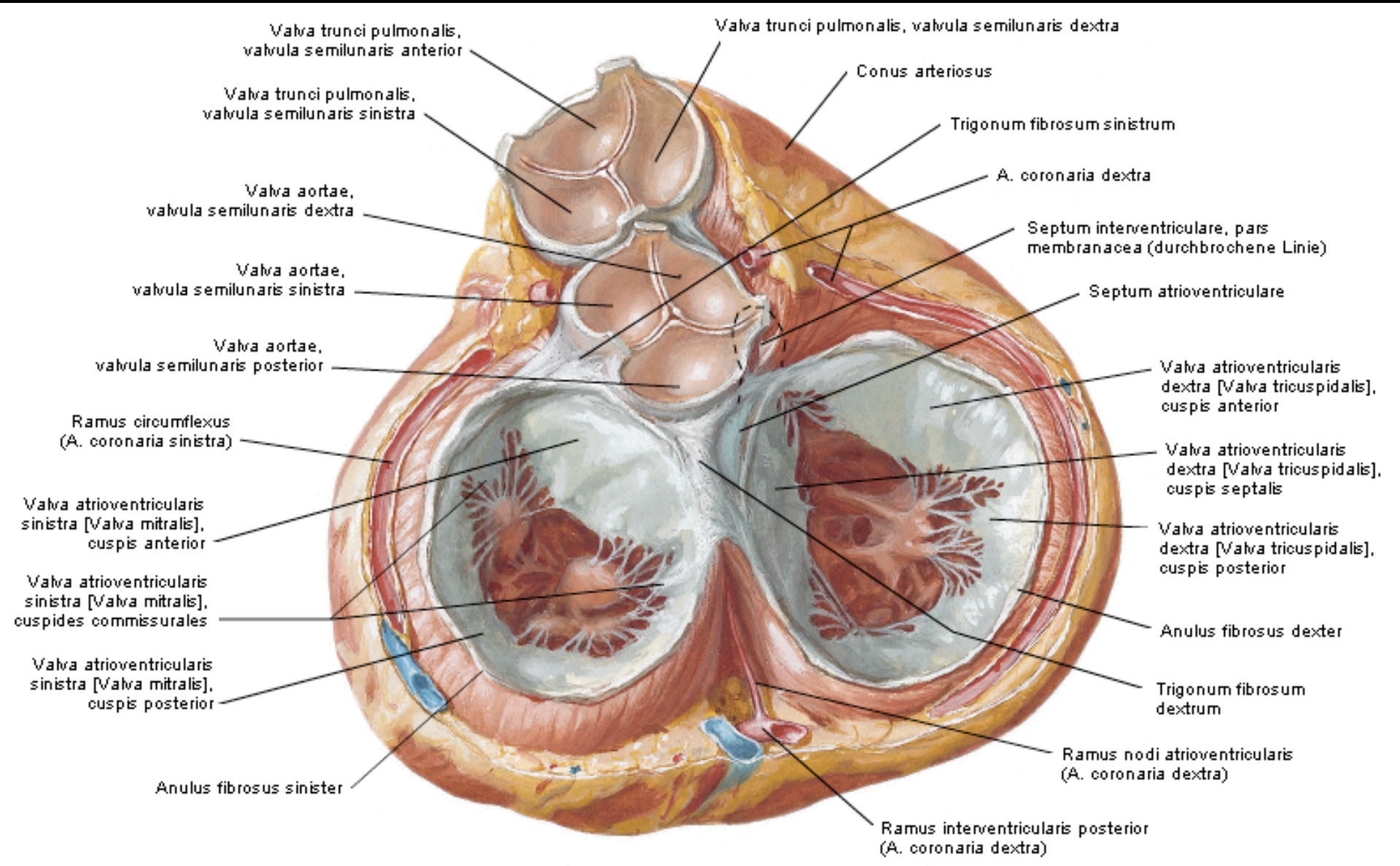
Rechtsseitige Klappenerkrankungen:
0.8% aller nativen Klappenerkrankungen

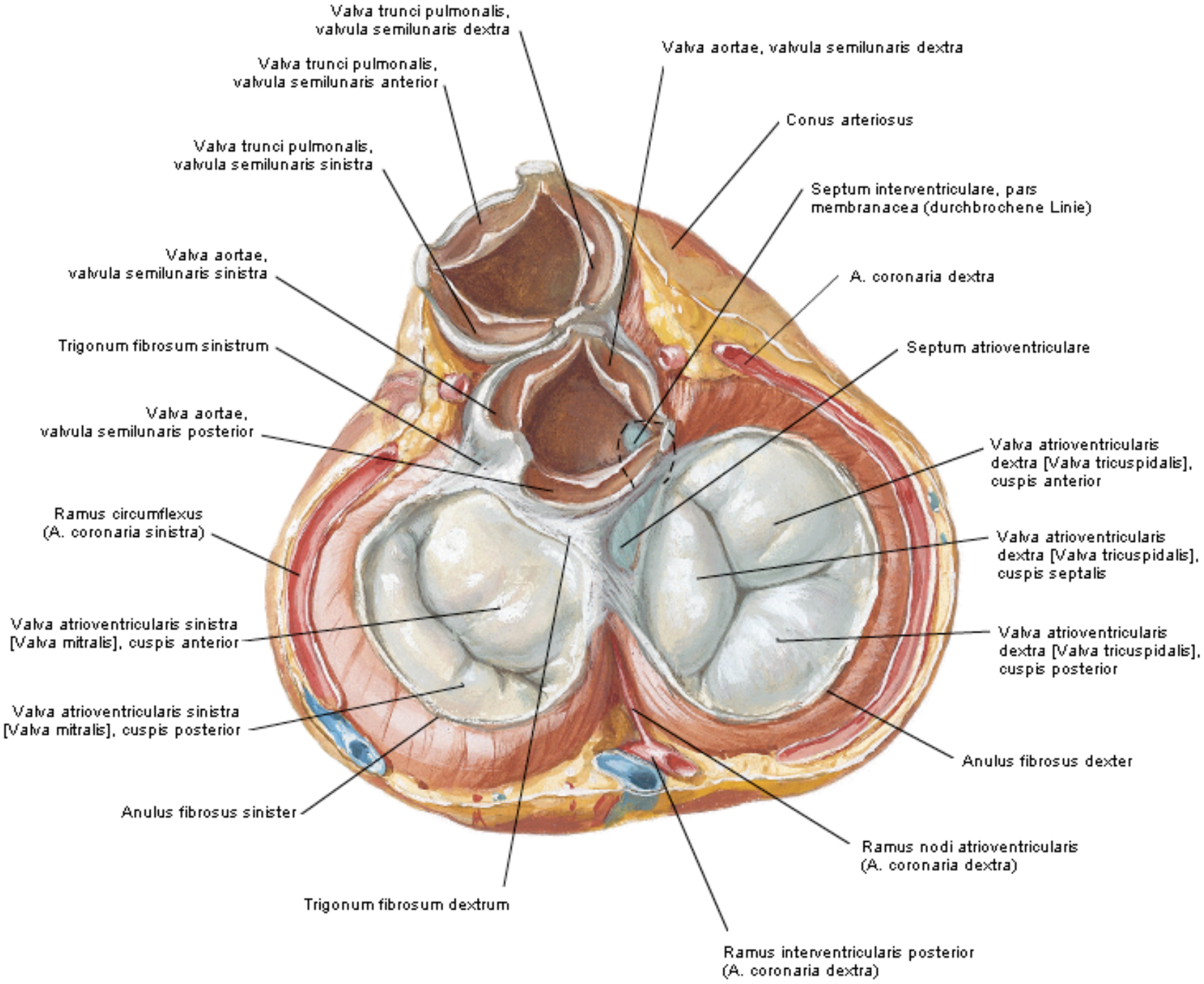
Nkomo et al. Lancet 2006;368:1005-1011

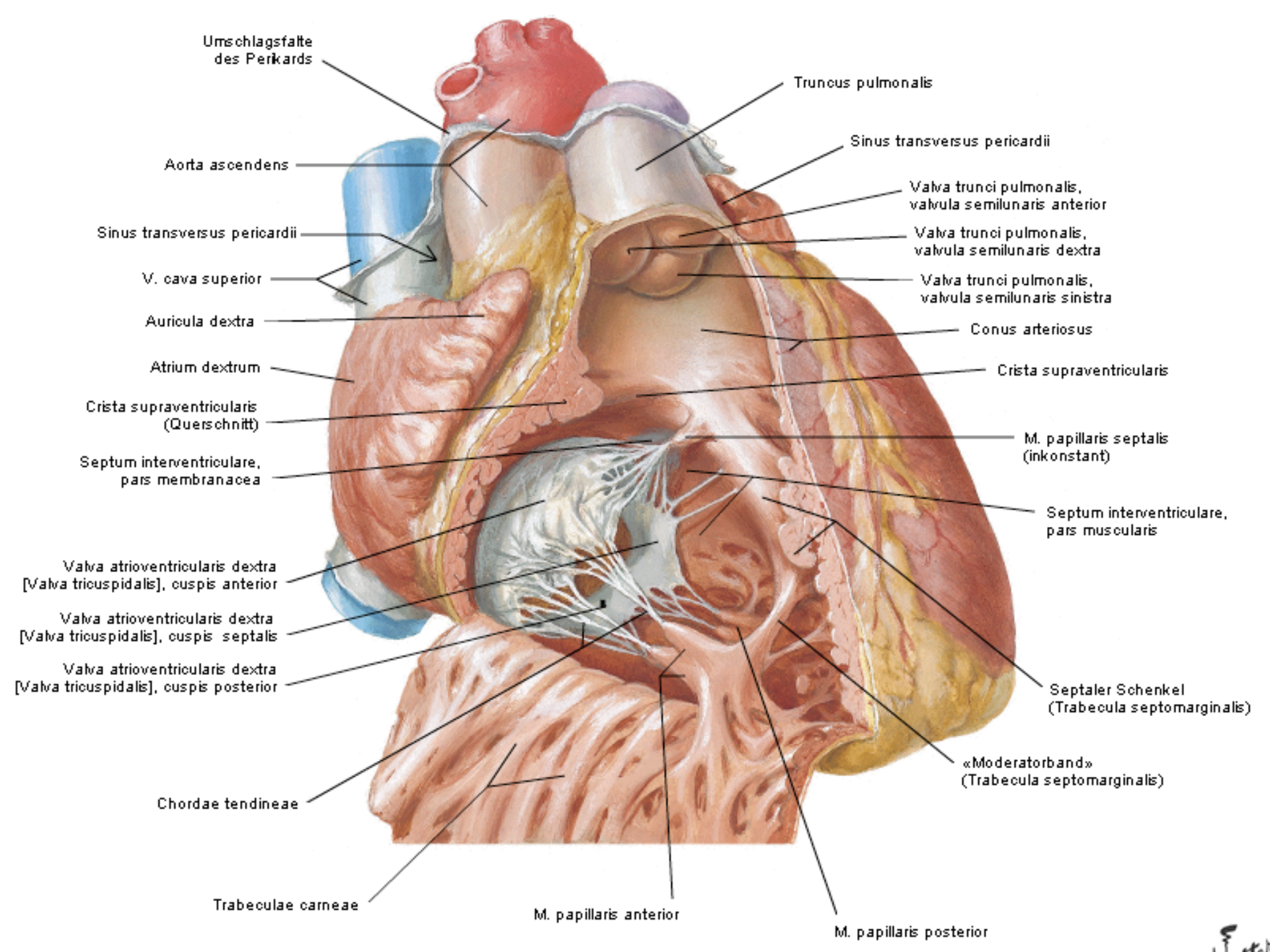
Tricuspidalklappenerkrankungen

Tricuspidalinsuffizienz

Tricuspidalstenose


Valva trunci pulmonalis, valvula semilunaris anterior
Valva trunci pulmonalis, valvula semilunaris dextra
Conus arteriosus
Valva trunci pulmonalis, valvula semilunaris sinistra
Trigonum fibrosum sinistrum
A. coronaria dextra
Valva aortae, valvula semilunaris dextra
Septum interventriculare, pars membranacea (durchbrochene Linie)
Valva aortae, valvula semilunaris sinistra
Septum atrioventriculare
Valva aortae, valvula semilunaris posterior
Valva atrioventricularis dextra [Valva tricuspidalis], cuspis anterior
Ramus circumflexus (A. coronaria sinistra)
Valva atrioventricularis dextra [Valva tricuspidalis], cuspis septalis
Valva atrioventricularis sinistra [Valva mitralis], cuspis anterior
Valva atrioventricularis dextra [Valva tricuspidalis], cuspis posterior
Valva atrioventricularis sinistra [Valva mitralis], cuspides commissurales
Anulus fibrosus dexter
Valva atrioventricularis sinistra [Valva mitralis], cuspis posterior
Trigonum fibrosum dextrum
Ramus nodi atrioventricularis (A. coronaria dextra)
Anulus fibrosus sinister
Ramus interventricularis posterior (A. coronaria dextra)


Valva trunci pulmonalis, valvula semilunaris dextra
Valva aortae, valvula semilunaris dextra
Valva trunci pulmonalis, valvula semilunaris anterior
Conus arteriosus
Valva trunci pulmonalis, valvula semilunaris sinistra
Septum interventriculare, pars membranacea (durchbrochene Linie)
Valva aortae, valvula semilunaris sinistra
A. coronaria dextra
Trigonum fibrosum sinistrum
Septum atrioventriculare
Valva aortae, valvula semilunaris posterior
Valva atrioventricularis dextra [Valva tricuspidalis], cuspis anterior
Ramus circumflexus (A. coronaria sinistra)
Valva atrioventricularis dextra [Valva tricuspidalis], cuspis septalis
Valva atrioventricularis sinistra [Valva mitralis], cuspis anterior
Valva atrioventricularis dextra [Valva tricuspidalis], cuspis posterior
Valva atrioventricularis sinistra [Valva mitralis], cuspis posterior
Anulus fibrosus dexter
Anulus fibrosus sinister
Ramus nodi atrioventricularis (A. coronaria dextra)
Trigonum fibrosum dextrum
Ramus interventricularis posterior (A. coronaria dextra)


Umschlagsfalte des Perikards
Truncus pulmonalis
Sinus transversus pericardii
Aorta ascendens
Valva trunci pulmonalis, valvula semilunaris anterior
Sinus transversus pericardii
Valva trunci pulmonalis, valvula semilunaris dextra
V. cava superior
Valva trunci pulmonalis, valvula semilunaris sinistra
Auricula dextra
Conus arteriosus
Atrium dextrum
Crista supraventricularis
Crista supraventricularis (Querschnitt)
M. papillaris septalis (inkonstant)
Septum interventriculare, pars membranacea
Septum interventriculare, pars muscularis
Valva atrioventricularis dextra [Valva tricuspidalis], cuspis anterior
Valva atrioventricularis dextra [Valva tricuspidalis], cuspis septalis
Valva atrioventricularis dextra [Valva tricuspidalis], cuspis posterior
Septaler Schenkel (Trabecula septomarginalis)
«Moderatorband» (Trabecula septomarginalis)
Chordae tendineae
Trabeculae carneae
M. papillaris anterior
M. papillaris posterior

Ursachen der Tricuspidalinsuffizienz

Ursachen:

Kongenitale Herzerkrankungen

Sekundäre Tricuspidalinsuffizienz
Pulmonale Hypertonie
Endokarditis
Rheumatisches Fieber
Medikamentöse Valvulopathie
Carcinoid Syndrom

Iung et al. Curr Probl Cardiol 2007;32:609-661

Ursachen der Tricuspidalinsuffizienz

1. Primary tricuspid regurgitation

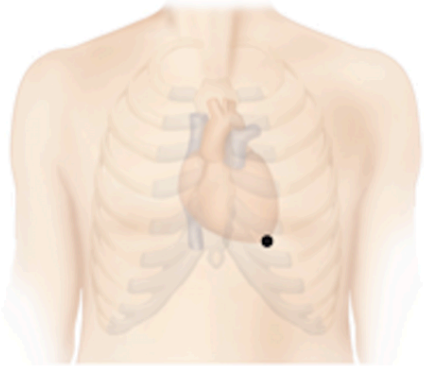
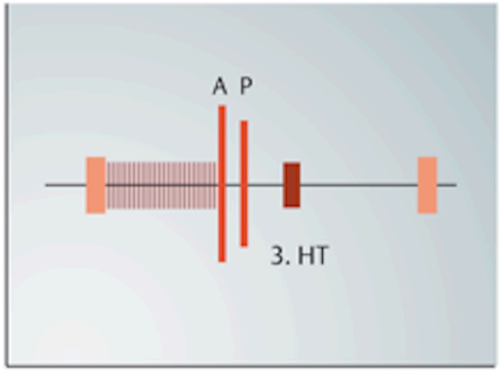
(A) Congenital	Tricuspid valve prolapse
	Ebstein's anomaly
	Tricuspid valve dysplasia (grades I–III)
	Abnormal number of leaflets
	Atrioventricular channel
	Cleft of a tricuspid leaflet
	Left sided tricuspid valve in congenitally corrected transposition of the great arteries
	Pulmonary atresia with intact ventricular septum
	Short tendinous chords
	Aberrant tendinous chords with tethering of the tricuspid leaflets
(B) Acquired	Endocarditis
	Rheumatic valve disease
	Right ventricular infarction
	Heart transplantation
	Carcinoid (or other tumours)
	Trauma
	Rheumatic arthritis
	Radiation therapy
	Papillary muscle dysfunction
	Hypereosinophilic syndrome
	Thyrotoxicosis
	Anorectic drugs

2. Secondary tricuspid regurgitation
3. Physiological tricuspid regurgitation

Kobza, R et al, Heart 90:319-323, 2004.

Tricuspidalinsuffizienz

Untersuchung von Patienten mit TI

Auskultationsort	Schematische phonokardiografische Darstellung	Key point
 p.m.: Herzspitze		Herztöne: 1. HT leise oder fehlend, 2. HT breit gespalten Extratöne: 3. HT Herzgeräusche: hochfrequentes, holosystolisches, bandförmiges Geräusch

Therapie der Tricuspidalinsuffizienz

Patienten mit Tricuspidalinsuffizienz sollten an einem Zentrumsspital behandelt werden

Ursachen der Tricuspidalstenose

Ursachen:

Kongenitale Herzerkrankungen

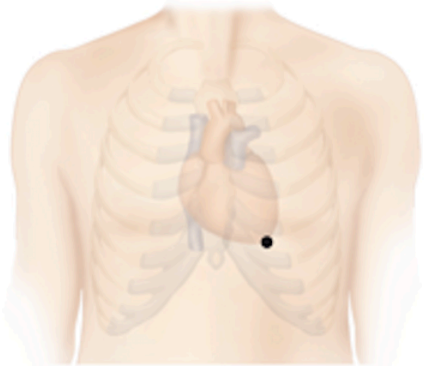
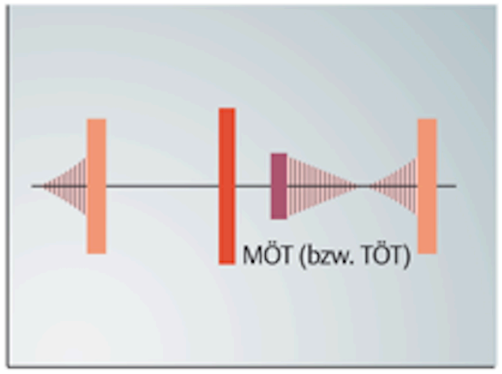
Rheumatisches Fieber
Medikamentöse Valvulopathie
Carcinoid Syndrom

Häufig kombiniert mit Tricuspidalinsuffizienz

Iung et al. Curr Probl Cardiol 2007;32:609-661

Tricuspidalstenose

Untersuchung von Patienten mit TS

Auskultationsort	Schematische phonokardiografische Darstellung	Key point
 p.m.: Herzspitze		Herztöne: paukender 1. HT und MÖT bei MS, evtl. TÖT bei TS Extratöne: keine Herzgeräusche: tieffrequentes, diastolisches Decrescendo-geräusch, evtl. Präsystolikum

Therapie der Tricuspidalstenose

Patienten mit Tricuspidalstenose sollten an einem Zentrumsspital behandelt werden

Echokardiographie bei Klappenerkrankungen

Frequenz der Echocardiographien in asymptomatischen Patienten with Klappenerkrankungen und normaler linksventrikulärer Function

Stage	Valve Lesion			
Stage	Aortic Stenosis*	Aortic Regurgitation	Mitral Stenosis	Mitral Regurgitation
Progressive (stage B)	Every 3–5 y (mild severity V_{max} 2.0–2.9 m/s) Every 1–2 y (moderate severity V_{max} 3.0–3.9 m/s)	Every 3–5 y (mild severity) Every 1–2 y (moderate severity)	Every 3–5 y (MVA >1.5 cm^2)	Every 3–5 y (mild severity) Every 1–2 y (moderate severity)
Severe (stage C)	Every 6–12 mo (V_{max} ≥4 m/s)	Every 6–12 mo Dilating LV: more frequently	Every 1–2 y (MVA 1.0–1.5 cm^2) Once every year (MVA <1.0 cm^2)	Every 6–12 mo Dilating LV: more frequently

Patients with mixed valve disease may require serial evaluations at intervals earlier than recommended for single valve lesions.
*With normal stroke volume.
LV indicates left ventricle; MVA, mitral valve area; VHD, valvular heart disease; and V_{max}, maximum velocity.

Nishimura et al. J Am Coll Cardiol 2014;63:e57-185